LOCAL TAXES AND GOVERNMENT CHOICES OF PUBLIC GOODS IN A SPATIAL EQUILIBRIUM MODEL
- IMPLICATIONS FOR CHINA'S LOCAL PUBLIC FINANCE REFORM AND URBAN GROWTH PATTERN

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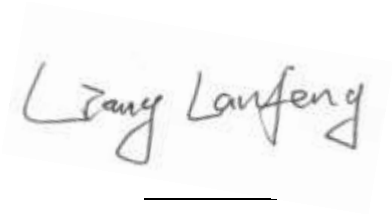
DECLARATION

I hereby declare that the dissertation is my original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in the dissertation.

This dissertation has also not been submitted for any degree in any university previously.



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Contents

Summary

Local public goods make a city productive and livable. Transportation infrastructure, for example, is a public capital input to the city's production. Public schools and healthcare services contribute to urban amenities that make the city more livable. The supply of local public goods is affected by the incentives faced by the local government who allocates the local fiscal revenue. The incentives, in turn, depend on the local government's preferences and the local public finance, which affects the government's budget constraint. This study investigates the incentives of a city government in allocating its revenue between public capital investments and public service expenditure in a spatial equilibrium model. The model takes into account cross-city factor mobility and compensating variation in the price of non-traded goods, which respond to changes in local taxes and local public goods.

We use the open-city model proposed in Glaeser and Gottlieb (2009) as our point of departure. The city in that model has a traded sector and a non-traded sector, each employing labor, private capital and public capital as factor inputs. Local consumers (workers) consume goods from both sectors plus local amenities, to which the access is free. As the consumer utility level and the rate of return on private capital are kept constant by free mobility, the city's wage rate, non-traded good price, population size, as well as outputs and land rents, are determined by the level of the public capital and local amenities in the city. We then introduce a public sector to the model, to endogenize the supply of local public goods. The public sector raises revenue from local taxes to finance expenditure on local public goods. We solve the allocation of the local budget between investments, which augment local public capital, and public services, which raises the level of local amenity, conditioning on the objectives of the local government and local tax structure that affects the impact public expenditure has on local revenue.

We consider two types of local taxes: a producer tax on the traded good and a

consumer tax on the non-traded good. We label the former as a value-added tax (VAT) and the latter as an ad valorem property tax (APT). We show that VAT, equivalent to an external demand shock, depresses the wage rate, non-traded good price, and city population size, holding the level of local public goods constant. The effect of APT is different; it depresses the non-traded good price and city size but raises the wage rate. APT makes the non-traded good more expensive to consumers, limiting the city size and, holding the level of local public goods constant, raising the city's labor productivity. Whereas the composition of the city GDP, in terms of the respective shares by the traded and non-traded sectors, is independent of the local public goods and unaffected by VAT, APT reduces the share of the non-traded GDP. Total land rent in the model equals GDP net of total wage, returns to private capital, and tax revenue. Both GDP and total land rent decrease with local taxes.

We employ the model to study issues related to urban performance and local public finance reform in China. In the past two decades, cities in China relied largely on producer taxes (VAT) and disposal of land for non-traded sector uses for public revenue, the property tax (APT) being absent. In addition, local officials are often promoted according to their performance in managing local GDP growth rather than local public services. We demonstrate that introducing APT to diversify the local tax bases can help to rationalize city size, even with public revenue held constant. The reduced city population size will raise labor productivity and hence wage rate, helping to reverse the declining trend of wage share in Chinese GDP in the past decade.

We further examine whether the opportunity cost of delivering a higher level of local amenities in terms of forgone investment in public capital can be affected by the structure of local taxes, when local balanced budget is maintained and the tax revenue is allowed to increase with concurrent public expenditure. The trade-off between the local amenity level and the public investment under balanced budget will affect the supply of public capital versus public services and hence the urban performance. For the case where the average (per capita) cost of public services increases with city population

size (due to congestion) when the level of public capital and amenity is held constant, we show that the opportunity cost of raising local amenity (via increased spending on public services) will be lower if the revenue is raised from a combination of VAT and APT instead of from VAT alone. APT rationalizes city size for a given level of local public goods. A more rationalized city size encourages the supply of public amenity when it lowers the cost of public services required to deliver the amenity. In such case, local public finance reform to diversify the local tax bases would spur local spending on public services as opposed to public investment, thus contributing to raising the low consumption share of GDP in China. In addition, the model can demonstrate that, when the local government puts more weights on local GDP performance as opposed to local amenities, as GDP performance is more important for local officials' career advancement, more local budget will be allocated to public investment at the expense of local public services. Our model is able to provide a connection between the political incentives of local officials and the excessive share of investment in GDP growth in China observed in the past decade.

Finally, we demonstrate that local public finance reform to introduce APT will meet political resistance from local governments, who rely on revenue from the disposal of land for non-traded sector uses, and from the local residents with Hukou, who are (*de facto*) landlords of the existing homes. The resistance arises because APT depresses the non-traded sector share of GDP and land rents, hurting an important revenue source for the local government and the real estate wealth of the residents.

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Chapter 1 Introduction

1.1 Motivation

Fiscal decentralization increases local government competition. There have been extensive studies on how local government competition provides various fiscal incentives in the US and in many other developed countries. Their findings showed that fiscal decentralization would enhance the local government's incentive for improving the welfare of the residents, due to the constraints of the "voting with hand" and "voting with feet" mechanisms. However, the studies on local government competition in developing countries are still rudimentary. The effects of local government competition for policy choices would deviate from the findings from developed countries, given the different fiscal systems, political institutions and local government's functions.

Fiscal decentralization reforms in western countries often provided local governments with more complete autonomies in deciding local tax rates and expenditures policies. In contrast, local governments in China are restricted with little taxation autonomy, while local expenditure autonomy and responsibilities are much more than that of developed countries. In addition, local governments in China are not elected directly by local residents, who are promoted mainly based on GDP of the jurisdiction. This makes the "voting with hand" mechanism invalid in China. Given these distinctions between China and the developed countries, the effect of local government competition resulting from fiscal decentralization in China needs to be further investigated.

Local government competition in China plays an important role in China's economy (Cheung, 2009). Inter-local government competition in capital investments contributes to its capital-intensive, industry-led economic growth pattern. For example, government investments account for 40 percent of the economic growth over past decades, of which local expenditures took up around 70 percent of total expenditures in 1994, and exceeded 80 percent in

2010. Among the local expenditures, more than 30 percent of fiscal revenues were spent on economic development in which the capital construction is included. Around 5 percent of fiscal expenditures were allocated to urban maintenance and construction expenditure. Average local public service expenditure including the education, health care, safety, etc. made up approximately 25 percent. In the US, state and local expenditure on public services consists of around 47 percent of total spending, while capital investment, such as highway, is 5.0 percent, and the utility spending comprises 6.6 percent (Barnett and Vidal, 2012).

The government's expenditure choice is affected by its tax regime. The current local tax system of China is dominated with valued-added tax and no residential property tax[1]. The value-added tax (VAT) makes up more than 50 percent of total local tax revenue (Figure C.3.1.2), which indicates that the VAT plays a critical role in local tax revenue. The share of VAT in local tax revenue is even higher by accounting for the tax rebates. The local property-type taxes contribute to less than 10 percent of local tax revenue, which are mainly levied on commercial real estates while the residential property is exempted from taxation. In contrast to many other countries, residential property tax is an important tax source for local public service financing. For example, local property tax percentage of total tax revenue is around 75 percent in the US, Canada 84.5 percent, British 93 percent and Australia 99.6 percent.

The government's expenditure choice is also affected by its objective. The local government in China is mainly focusing on GDP, because which is used to measure the officer's performance.

The aim of this study is to revisit the relationship between local tax system and local government's expenditure competition. We examine the incentives of local government's public good choice between public capitals and public services. An emphasis will be placed on the comparison between the

[1] see Appendix C for the detailed introduction into China's fiscal system.

value-added tax regime versus the residential property tax regime. This study will also explore the incentives from local government's prior objective of GDP versus the local resident's quality of life.

We use a spatial equilibrium approach to do the analysis, which is based on Glaeser and Gottlieb (2009). We extend their model to study the effect of taxes on urban performance by adding balanced budget constraint and local government's utility from GDP and the quality of life.

1.2 Findings and Contributions

Our finding shows that the city size associated with value added tax is larger than that with residential property tax in China, which causes local government's incentive to invest more public capitals than provide public services, because larger population size induces higher public service expenditures and results in a higher opportunity cost in terms of sacrificing public capital investment. This result demonstrates that China's current local tax system dominated with VAT and without residential property tax contributes to its public expenditure choice in favoring capital investment to public service provision.

We also compare the impacts from these two tax regimes on the housing rental price and local wage. Our finding shows that housing rental price is higher but wage rate is lower with VAT than residential property tax. This result explains the current phenomena of relatively high housing rental price but low local wage rate in China's big cities.

The analysis of the incentive from local government objective of GDP versus the quality of life verifies that the primary objective of GDP accounts for local government's enthusiasm on public capital investment, as opposing to public service provision.

These findings provide significant policy implications for China's fiscal

reform. First, given no data available on residential property tax at the present, this study adopting the numerical approach is an innovative contribution. Second, despite consensus of the GDP objective's impacts on government's biased expenditure choice in China, few studies have theoretically examined this argument. Third, this study suggests a prescription on promoting a sustainable economic growth by implementing residential property tax, as to counteract the negative impact of the shrinking export demands since the global financial crisis in 2008.

1.3 Organization of the Dissertation

The remainder of this dissertation proceeds as follows.

Chapter 2 provides a literature review on fiscal decentralization. It provides an overview on the effects of public goods and the property tax on city performance. It also reviews the public goods choice in the local tax system of property tax literature. In the last section of this chapter it investigates the modeling issue with related to local government's objectives.

Chapters 3 establishes the theoretical model, which includes a general model and a specific formulation of the general model. The general model provides detailed articulation of the model setup and addresses the issue of public goods specification in the production and utility functions. The specific form of the model is built on Glaeser and Gottlieb(2009) with Cobb-Douglas functions of the traded and non-traded goods productions, the household's and the government's utility.

Chapter 4 analytically explores the comparative static tax effects on city performances in terms of local wage rate, housing rental price, city size, traded and non-traded sector's outputs and land rents, and their ratios, which disclose the mechanisms how the taxes affect the city economy. Based on the above analyses, it further explores the government's expenditure incentives for the choice between public capital and public service from the tax system and the

government objective, separately.

Chapter 5 parameterizes the model to analyze the impacts of residential property tax reform on China's economy. Furthermore, it explores the different responses to the residential property tax reform with various types of cities. In the end of this chapter, policy implications are drawn upon those findings to facilitate the residential property tax reform.

Chapter 6 summarizes the major findings, contributions and proposes potential extensions of this study.

Chapter 2 Literature Review

2.1 Introduction

We study the local taxes and government's incentive for public goods choice. The relevant studies in this review include the public goods impacts on city performances, the property tax effects on city performance, the government's objectives and the public goods choice. The review of the above issues is discussed in sequence in the follows.

2.2 Public Goods and City Performances

The effects of public goods on economic performance have been extensively examined in the empirical study (for example Aschauer, 1989; Munnell, 1990 and 1992). Some of the findings argue that public goods have negative impacts on the aggregate economic output, while others find the opposite effects. Haughwout (1998) argues that most of these studies conducted in a partial equilibrium analysis ignore the feedback effects of the public infrastructure, as some of them used the aggregate production function (APF) by taking the capital stocks as fixed, which ignores that the capital is free mobile, while some others used the aggregate cost function (ACF) that ignores the compensating effects of local wages to house prices. The original work of Rosen (1979) and Roback (1982) study the adjustments of local wages and housing prices to varying urban amenity; however, they ignore the productive inputs of public capitals in the traded and non-traded goods production. Glaeser and Gottlieb (2009) discuss the impacts of non-traded capitals and local amenity on the local wage rate, housing rental price and city size in a general equilibrium model. Their model is advantageous in contrast to others in accounting for compensating price with both non-traded capitals and local amenities.

Our model built upon Glaeser and Gottlieb's has the above advantages as

Glaeser and Gottlieb's that is a full-fledged model, nevertheless, it overcomes the weakness of their model in taking local non-traded capitals and urban amenities exogenous.

2.3 Property Tax and City Performances

Tax incidence theory addresses who ultimately bears the tax burden, accounting for tax effects on equilibrium product and factor prices, which is usually the focal point of local public finance. Tax incidence studies generally include "differential tax incidence" and "balanced budget incidence." The studies of "differential tax incidence" examine how manipulation of the tax regime, given the same tax revenue, directly impacts a city's performance; the "balanced budget incidence" research focuses on how the expenditure choice changes depending on the shift of the tax regimes. The major difference between the two approaches is that the "differential tax incidence" analysis ignores the effect on the expenditures, whereas the "balanced budget incidence" analysis accounts for the impacts on the expenditure choice. The "differential tax incidence" approach is more appropriate in comparing different financing instruments impact on city performances by disentangling the effects from public goods. However the "balanced budget incidence" is a better approach from a general equilibrium framework's point of view, which can be utilized to analyze the government's public good choice. The decision regarding which approach should be utilized depends on the specific type of issues being addressed.

2.3.1 "Differential Tax Incidence"

Three views of property tax incidence have been summarized in Zodrow (2007): the traditional view, the "benefit tax" view, and the "capital tax" view. The traditional and "capital tax" view both agree upon the distortionary feature of property tax.

The traditional view argues that a higher property tax on residential housing will result in a higher housing price. Under this view, the burden of taxing the

housing structure is shifted to the housing consumers, which resembles to the "excise tax" effect, because the housing capital is perfectly mobile.

The benefit view, originating from Tiebout (1956) argues that property tax is a non-distortionary tax, because the taxes paid are the user fees for public good consumption. This argument, however, when placed in a heterogeneous household preference framework, would face the "free riding" problem. Residents may consume less housing in the community with better public goods. Although in a homogenous household framework, this "free riding" problem may not occur. Hamilton (1976) demonstrated that fiscal zoning can transform the property tax into benefit tax by keeping the amount of housing consumption constant for each resident. However, his view is based on the critical assumption that the fiscal zoning is sufficiently precise to control the housing consumption to a given amount.

In contrast to the benefit view, the "capital tax" view developed by Mieszkowski(1972) argued that property tax is a distortionary tax, which alters the price of housing and consequently, the consumption behavior. This "capital tax" view is developed in a number of jurisdictions with differential tax rates. It argues that in a nation with a fixed total capital supply, the average tax rate on capitals across jurisdictions imposes the depressing effect on the returns of capital, which can be seen as "profit tax". While the differential tax rate in individual regions exhibits the "excise tax effect" that any capital tax beyond that average tax rate level will be capitalized into local prices born by the consumers. Therefore, Zodrow(2007) argues that the "capital tax" view can encompass the traditional view and the "benefit view".

The "benefit view" is distinct from the "capital tax" view in that the "benefit tax" view does not envision the property tax as a real burden, while the "capital tax" views property tax as a burden in referring to its "excise tax" effect with the average tax rate. They are also differing in that the "benefit tax" is studied with a uniform property tax rate, while the "capital tax" view focuses on differential tax rates.

Mieszkowski(1972) found that the tax differentials across jurisdictions would

lead to the "excise tax effect" which are capitalized into local housing price. On the other hand, the average capital return is depressed by the average capital tax rate which will not affect the housing price. For the sake of convenience, his model abstracted from the expenditure side, although the problem of doing so has been mentioned in his paper. Their model assumes after-tax wage rate equals across regions as a result of labor mobility. However, it is criticized because the real wage rate (or utility) would be different due to the differential housing price, which will result in no equilibrium.

Polinsky and Rubinfeld(1978) studied separately the effects of property tax and public goods on housing price and land rent in a spatial model. They found that an increase in property tax rate will cause the total-of-tax housing price, capital price and wage rate to increase, whereas, the net-of-tax housing price and land rent fall. When the public good is increased holding tax rate constant, the price of land will increase and the wage rate decreases.

Brueckner(1981) assumed that labor mobility generates equal utility at equilibrium, but the utility level is varied endogenously. This is because the impacts of property tax policy on the economy's reservation utility cannot be neglected with only two large communities composing the whole economy. He found that the taxing jurisdiction induced a higher gross-of-tax housing price and wage rate on one hand, while a lower land rent on the other hand. However, their model is limited with the assumption that the government spends the tax revenue in a manner that can cancel the income effect of any tax change.

Lin(1986) accounted for the disposal of the residential property tax revenue, but he treated it as a lump-sum transfer back to residents; he found that property tax reduced the land rent and the net-of-tax housing price, but increased the total-of-tax housing price and the wage rate in the taxing jurisdiction. Zodrow and Mieszkowski (1986) found that differential property tax has an "excises tax" effect consistent with the traditional view of property tax incidence, but the property tax in their study refers to taxation on mobile capital, hence it is a "capital tax".

The studies on property tax effects on city performances, such as house price, wage rate and land rents, have focused on different tax bases. Some property tax base is mobile capital (e.g. Mieskowski, 1972; Zodrow and Mieszkowski, 1986), another is referred to land rent (or land value), and others consist of both land and its improvement (Arnott and MacKinnon, 1977; Polinsky and Rubinfeld, 1978; Brueckner, 1981; Lin, 1986). In this study, we focus on the residential property tax on both land and its improvements at the uniform tax rate, because the property tax that is based on both structure and land can address, to some extent, the issue of financing congested public goods. According to Henry George, for efficient public good financing, land rent should be fully taxed; however, when taking into account the congestion of city size with the public good consumption, head tax is required to complementing the land tax. The property tax that is based on both structure and land can, to some degree, mimic the role of combining head tax and land tax. In addition, the property tax is often found favorable in local public finance is due to the administratively easy operation for its location-specific feature (Wilson, 2003).

2.3.2 "Balance Budget Incidence"

Tiebout(1956) argues that residents "shopping" among communities will lead to an efficient supply of local tax/public service package. It implies that resident locational decisions are affected not only by local taxes, but also by local public services. The studies used to examine the efficient local provision of public goods often failed to reflect the full spirit of Tiebout by delinking the tax revenues and expenditures. For example, the empirical study of Oates(1969) and the theoretical study of Polinsky and Rubinfeld(1978) both analyzed separately the tax and public good effect on rental price[2] in a general equilibrium model without budget constraint. Lin(1986) accounted for the residential property tax revenue as being returned to residents in a lump-sum manner. These analyses ignore the feedback effects of the public expenditure on the tax bases, hence the tax revenue.

[2] and local wage rate for Polinsky and Rubinfeld(1978).

The importance of balance budget analysis has been recognized by some following scholars. For example, Brueckner(1979) analyzed the public good provision efficiency through property tax value maximization under balance budget constraint; however, he did not mention that different tax sources may favor one type of public good compared to the others. His study is different from ours because we consider the different incentives of tax regimes on a government's choice among multiple public goods. In addition, when he discussed the tax effects on housing service or wage income, he implicitly assumes that the utility is separable in its consumption components, while the cost function of production is separable in its inputs, respectively. Therefore, when he analyzes multiple public goods, there is a possibility for multiple tax rates to correspond to various tax types that satisfy the efficient condition. Our study may not be able to achieve the efficient tax level conditions, due to the use of a general tax source to finance all three public goods. Wilson (2005) analyzed the welfare effect of competition for mobile capital via both capital and income taxes. It emphasized the importance of the feedback effect in supplying public inputs to firms. Its finding showed that the expenditure competition on public inputs improves the resident's welfare in an open economy. These aforementioned studies focused on only one type of public good; there are also other studies involving the balanced budget analysis paid attention to the composition of the public goods provision.

Keen and Marchand(1997) studied the impact of tax competition on the composition of public goods. Despite fruitful findings from their study, we focus only on its analysis on the composition of public goods under a single tax regime-capital tax. Local public goods were divided into public capital and public service which were financed by the capital tax on private capital. Their finding suggested that public capital would be oversupplied relative to public service in a non-cooperative equilibrium. However, their model is restrictive, because they assume labor immobility. It is argued that with labor mobility, the findings could be inconsistent which was testified by Matsumoto (2000). His finding showed that capital taxation did not distort the mix of public services and public capitals under both labor and capital free mobility, even

though the overall level of public expenditure was inefficiently low. In addition to classifying public good into public capital and public service, some studies also only focus on distinguishing public capitals. Matsumoto (2004) differentiated public capital into two types: one complementing to immobile factor and the other complementing to mobile factor respectively in traded good production. His finding suggested that local governments competing for capital tax base tend to undersupply both the public inputs.

In sum, the existing literature of the public good's choice did not pay enough attention to how different tax regimes would affect the composition of public goods, especially with respect to the VAT versus residential property tax regime. Therefore, this study examines the public capitals versus public service choice under the VAT regime in comparison to the APT regime with the condition of equivalent revenue and accounting for the feedback effect of the public goods.

2.4 Local Public Goods Choice and Local Government's Preference

Local government objectives can be described as either altruistic or selfish or a conglomeration of both traits. Correspondingly, there are three types of literature in treating local government objective functions: one is the "benevolent" government, another is the "Leviathan" government, and the other is a mixture of the "benevolent" government and "Leviathan" government.

2.4.1 "Benevolent" government

"Benevolent" government is characterized by the objective of maximizing its residents' welfare. Literature on this type of local government competition has achieved different results of welfare effects which can be either welfare-improving or welfare-worsening under different settings. The view of

welfare-improving is supported by the original work of Tiebout. In Tiebout's framework, residents are mobile without taking into account firms; local governments competing for mobile residents will provide public goods at minimum costs; hence, the equilibrium outcome will be efficient. Following Tiebout's framework, other authors extend the model to analyze local governments' competition for mobile firms, their findings as well support that the public goods provision by local government is efficient (White, 1975; Fischel, 1975). On the contrary, some literatures support the proposition of welfare-worsening tax competition, as Oates (1972) states that

"The result of tax competition may well be a tendency toward less than efficient levels of output of local services. In an attempt to keep taxes low to attract business investment, local officials may hold spending below those levels for which marginal benefits equal marginal costs, particularly for those programs that do not offer direct benefits to local business."

Following Oates' framework, other studies investigating the effects of competition for mobile capital support the claim that local government tax competition will cause a "race to bottom" (Zodrow and Mieskowski, 1986; Wilson, 1986; see Wilson (1999) for a literature review).

In Tiebout's framework, the strong assumption is that mobile households are well informed and fully reveal their preferences. The "head tax" becomes a benefit tax which perfectly fits into the each household's valuation of the public goods. Thus, each resident receives what he pays. Hence, local public goods provision in equilibrium is efficient. Literature that study mobile firms and obtain the same findings as Tiebout's often start with the similar assumption of perfect information, in which mobile firms are fully informed about the costs of public capitals. In the end, each firm received the benefits of public inputs same as the costs they valued.

"Fiscal externalities" is a major concern for local government's expenditure choice, which is induced by the cross-border impacts of one region's public policy on the other regions' budgets. For example, increasing the capital tax in

one region will cause capital outflow and thus benefit the other regions by increasing their tax base and hence increasing their budget revenues. The major departure of the "race to bottom" literature from Tiebout's lies in their treatment of "fiscal externalities". Tiebout's literature does not take into account the "fiscal externalities" while the "race to bottom" literature does.

2.4.2 "Leviathan" government

"Leviathan" government is characterized by the objective of maximizing its budget size. Brennan and Buchanan (1980) suggest that local governments focus on its own personal interests and may not consider the interest of their residents. Self-interested governments have a tendency to overspend. In turn, the tax rate will be set too high, beyond which local residents prefer. For this reasoning, the tax competition for mobile resources that prevent the local governments from over spending could be regarded as increasing its efficiency. Alternatively, McLure (1986) supports the stance that tax competition fosters welfare-improvement, because tax competition forces local government to improve their tax structures.

2.4.3 Combination of "Benevolent" and "Leviathan" government

The "benevolent" government and "Leviathan" government are two extreme cases of local government objective that possess pure altruism or selfishness. Some authors addressed this gap by discussing the local government in between the social welfare and the personnel rent (Rauscher, 1998; Edwards and Keen, 1996). However, the results are obscure because the political rent seeking generates the effects that are opposite to that of fiscal externalities. Although political rent is taken into account in the model, they are exogenously specified and thus fail to take into account the political process.

In sum, the local governments with the GDP objective have not received

enough attention. This study examines the effects of local governments' preference of GDP as opposing to quality of life on their public good choice between public capital investment and public service supply. This specific feature of China's local government's enthusiasm for the GDP, as has been well-documented, distinguishes this study from many others.

2.5 Summary

This study utilized the general spatial equilibrium model to analyze the public goods choice under the VAT versus the residential property tax with government's objective of GDP versus the quality of life. It extends Rosen(1978), Roback(1982) and Glaeser and Gottlieb(2009) by endogenous local non-traded capitals and urban amenities, which are supplied by local governments. This extension accounts for the variation of city performances from the institution perspective of local tax system and the political incentive. Besides, this study can add to the extant literature of fiscal decentralization and government expenditure competition with its full-fledged model setup and accounting for the endogenous feedback effects of the public expenditures on tax revenues.

Other contributions of this study attribute to the specific institution features of China. First, the fiscal incentive analysis focusing on VAT versus APT is relatively under explored. Second, the political incentive of GDP measurement of governance legitimacy is less investigated.

Chapter 3 An Open Economy Model

3.1 The Setting of the Urban Economy

There are many small open economies in the system, referred to "cities". In each city, there are two production sectors: traded goods sector and non-traded goods sector (e.g. housing sector). The traded goods sector produces traded goods using private capital, public capital and labors. The non-traded goods sector produces non-traded goods using similar inputs. Each sector is freely entered and perfectly competitive. Producers choose private inputs taking public capitals and the prices of product and factor as given. We assume resident-workers, who work where they live, to exclude commuting cost. Resident-workers have uniform preferences and can freely move between cities. Cities are small enough that the reservation utility is exogenous. The private capital return is exogenous which is determined in the world market; the private capital incomes are assumed not to be reinvested in the city. Resident-workers consume local amenities consisting of local natural amenities and public services, traded goods and non-traded goods.

At equilibrium, location equilibrium requires that workers must be indifferent between locations when workers receive their reservation utilities; factor market clearing requires that the marginal product of labor equals local wage rate, and the marginal product of capital receives competitive rate of return; product market clearing requires that housing supply equals housing demand. These three conditions collectively determine city size, local wage rate, and housing prices.

The traded goods can be traded to exchange for private capitals. Local governments supply three public goods referring to public capital T in traded goods production (e.g. port), public capital H in non-traded goods production (e.g. road), and public service (e.g. health care). Local governments do not

directly produce the public goods but rather purchase from the private producers. All public goods used in production and consumption are not directly paid for by user fees or charges. Local public good provision is financed by alternative tax regimes: value-added tax (VAT) or ad valorem property tax (APT).

It also assumes that there is an absentee landlord in the model who claims all the land rents[3]. These are the residuals of the production output net of the costs of private capitals and labor inputs. With this treatment, any profit induced by public inputs will be accrued to the landlord; this assures that there will be zero profit at equilibrium.

Since the cities are symmetric in terms of homogenous firms, developers and households, a single representative city can be chosen for this analysis with city-specific subscripts suppressed. Local government competition in this framework is a Nash competition.

3.1.1 The Firm's Problem

Each individual firm produces traded goods using private capital (k_T), public capital T (z_T) and labors (l_T). Each individual firm's production function is $f(z_{Tj}, k_{Tj}, l_{Tj})$; j denotes the jth individual firm. The private capital is purchased in the world market with the exogenous price of r (interest rate). Labor is employed from a competitive labor market with an endogenous local wage rate w.

Public capital T is assumed to be sector specific public input, which is rivalry within a firm but can be rivalry or non-rivalry among firms within the industry and it is non-excludable. The condition of rivalry within a firm is to ensure that given the public capital, each firm's production is decreasing return to

[3] Later in Chapter 5, this absentee landlord assumption will be relaxed to analyze the allocation of incremental land rent in the non-traded sector to provide political economic implications on property tax reform.

scale; hence, firms cannot infinitely increase other inputs to make positive economic profits. The identification of the public capital in an industry is not essential, because we use the aggregate form of the public capital in the city aggregate production function. The proof is as follows.

For rivalry and non-rivalry public capital T, the aggregate public capital T (Z_T) and the individual firm's public input has the following relationship,

$$\begin{cases} \sum_{j=1}^{m} z_{Tj} = m \cdot z_T = Z_T, \text{ for rivalry public capital T} \\ z_T = Z_T, \text{ for non-rivalry public capital T} \end{cases} \quad (3.1)$$

The aggregate production function equals the sum of the individual firm's production function. For the rivalry and non-rivalry public capital T, the aggregate production function is $f_T\left(m{\cdot}z_T, m{\cdot}k_T, m{\cdot}l_T\right)$ and $f_T\left(z_T, m{\cdot}k_T, m{\cdot}l_T\right)$ as in the follows,

$$F_T(Z_T, K_T, L_T) = \begin{cases} \sum_{j=1}^{m} f_T(z_{Tj}, k_{Tj}, l_{Tj}) = f_T(m \cdot z_T, m \cdot k_T, m \cdot l_T) \\ \sum_{j=1}^{m} f_T(z_{Tj}, k_{Tj}, l_{Tj}) = f_T(z_T, m \cdot k_T, m \cdot l_T) \end{cases} \quad (3.2)$$

Using the notation of aggregate public capital T Z_T to replace the sum of the rivalry and non-rivalry public capital T inputs, that is $m \cdot z_T = Z_T$ and $z_T = Z_T$, the aggregate function of the traded good production is uniformly stated as $Q_T = F_T\left(Z_T, K_T, L_T\right)$. Hence, the specification of the rivalry or non-rivalry among firms does not affect the formulation of the aggregate production function.

In the aggregate production function, the total public capital T input Z_T is determined by the initial stock (Z_{T0}) and the incremental investment by local governments (I_T); K_T is the aggregate private factor input which equals the

sum of individual inputs; L_T is the total labor input which equals the sum of individual labor inputs. The marginal product of each input is decreasing. It is assumed that the individual firm uses constant returns to scale production technology on all factors. Hence, the aggregate production function is decreasing return to scale given that the productivity and public capital are fixed. The non-exclusionary feature of public capital justifies the government's provision.

Traded goods are considered as the numeraire and the aggregate output is subject to VAT: τ_v. The net-of-tax traded goods price is $P_X(\tau_v,1)=(1-\tau_v)\cdot 1$, and the net-of-tax total output is $P_X Q_T$. Firms choose private capitals and labor inputs to maximize after-tax profits by taking public capital T and prices as given. At equilibrium, free entry and the assumption of absentee landlord assures that there will be zero profit, because any profit induced by pubic inputs will be accrued to the landlords. Firms will receive competitive after-tax return of private capital: $\partial(P_X Q_T)/\partial K_T = r$. The marginal product of labor will equal to local wage rate: $\partial(P_X Q_T)/\partial L_T = W$.

These two conditions can determine the factor demands in terms of net-of-tax price, factor prices and total stock of public capital T: $K_T = K_T(P_X, r, W, Z_T)$ and $L_T = L_T(P_X, r, W, Z_T)$. Assuming that the agglomeration economies affect firm's production in a Hicks-neutral way, such that the relative employment of private factors inputs are not changed, the productivity of the traded goods sector is then represented with $A = aN^{\omega}$. Hence, the traded goods output function is $Q_T = Q_T(P_X, r, W, Z_T, N)$, which depends on the net-of-tax product price, the factor prices, the stock of public capital T and the city size.

Since the public capitals are not directly paid through user fees or charges, the benefit of the public capitals is accrued to land owners through land rent. Then, land rent in the traded goods sector is the residuals of the production output net of private capital and labor inputs:

$$R_T = P_X Q_T\left(P_X, r, W, Z_T, N\right) - r \cdot K_T\left(P_X, r, W, Z_T\right) - W \cdot L_T\left(P_X, r, W, Z_T\right) \quad (3.3)$$

3.1.2 The Builder's Problem

Individual developers produce non-traded goods (e.g. housing services) using three inputs similar to traded goods production: private capitals, public capital H and labors[4]. The production also uses constant return to scale technology for all inputs. Neglecting the individual production function, step forward to look at the aggregate production function, the production function of the non-traded good is $Q_H = F_H(Z_H, K_H, L_H)$. The non-traded goods price P is a local price, which is endogenously determined by local fiscal conditions. The aggregate output of non-traded goods is: $PQ_H = P \cdot F_H(Z_H, K_H, L_H)$.

Developers choose private capital and labor inputs to maximize their profits, given public capital H. At equilibrium, private capital will receive the competitive rate of return which is determined in the world market: $\partial\left(PQ_H\right)/\partial K_H = r$, and the marginal product of labor equals to local wage rate: $\partial\left(PQ_H\right)/\partial L_H = W$.

From the above two conditions, the private capital demand is determined by local non-traded goods price, factor prices and the stock of public capital H: $K_H = K_H\left(P, r, W, Z_H\right)$. Similarly, labor demand function is $L_H = L_H\left(P, r, W, Z_H\right)$. The quantity output of non-traded goods depends on the non-traded goods price, factor prices and the stock of public capital H: $Q_H = Q_H\left(P, r, W, Z_H\right)$; the total value of non-traded goods is: $PQ_H = P \cdot Q_H\left(P, r, W, Z_H\right)$.

In this study, since there is no tax directly levied on developers, the benefit of public capital H is fully capitalized into land rent, which assures the zero profit of non-traded sector at equilibrium. Non-traded sector land rent is the residuals of the non-traded goods output net of the private capital and labor inputs:

[4] Public capital H is similar to public capital T except that it is non-traded sector specific.

$$R_H = P \cdot Q_H\left(P, r, W, Z_H\right) - r \cdot K_H\left(P, r, W, Z_H\right) - W \cdot L_H\left(P, r, W, Z_H\right) \quad (3.4)$$

3.1.3 The Resident-worker's Problem

Each resident consumes local amenities (Θ), traded goods (q_T), and non-traded goods (q_H). The utility function is denoted as $U\left(\Theta, q_T, q_H\right)$. Each resident is endowed with one unit of labor and uses it completely in production without leisure consumption. The only income source is labor income W. Local amenities Θ consist of public service θ and natural amenities $\underline{\theta}$: $\Theta = \theta + \underline{\theta}$. Public service θ is considered as a one-time consumption good[5]; $\underline{\theta}$ is a natural amenity (e.g. weather). Residents purchase traded and non-traded goods to maximize its utility, given local amenities. Traded goods price is unity and the non-traded goods rental price is P. Since the consumption of non-traded goods is subject to property tax τ_P, total of tax housing price is $P' = \left(1 + \tau_P\right) \cdot P$. The traded goods consumption equals $q_T = q_T\left(P', W\right)$. The housing service consumption is $q_H = q_H\left(P', W\right)$. Hence, the indirect utility is $V\left(P', W, \Theta\right)$. To simplify the analysis, we apply the treatment of Wilson (1986) in the utility formation. Two assumptions are made: (i) the local amenities are weakly separable from private goods consumptions; (ii) the private goods consumptions are homogenous of degree one.

At equilibrium, residents receive reservation utility:

$$V\left(P', W, \Theta\right) = U_0 \quad (3.5)$$

[5] By assuming that public service is a one-time consumption good, it seems that the public service provision is unrelated to the previous supply level, however, this is not necessary the case, because the incumbent government needs to at least to provide the previous level of public service to maintain the population.

3.1.4 The City Government's Problem

In this framework where there are many small open cities, all cities initially implement VAT, but then, one of the cities switches from VAT regime to APT regime. This change of one city's tax system would have little effect on the nation's reservation utility as well as the exogenous private capital return, because there are so many small open cities. The tax regime shift of a single city, which causes changes in its local prices and city size, would create a negligible impact on the other cities. Hence, its local government takes the prices of traded goods and private capitals as exogenous, and chooses public goods provision independent of the other city governments' choices to maximize its utility subjected to budget constraint.

Local government's objective consists of aggregate economic output and the quality of life. Local aggregate economic output (GDP) includes both net-of-tax traded goods and non-traded goods output and tax revenues by applying income approach:

$$GDP = P_X Q_T + PQ_H + \tau_v \cdot Q_T + \tau_P \cdot PQ_H \qquad (3.6)$$

The quality of life is represented by local amenities Θ. Therefore, the utility of local government can be denoted with $U_g\left(GDP, \Theta\right)$.

Assuming no depreciation of local public capitals, local government investments in public capital T is I_T and public capital H is I_H. Therefore, the total capital stocks available after local government investments are $Z_T = I_T + Z_{T0}$ and $Z_H = I_H + Z_{H0}$; Z_{T0} and Z_{H0} are the initial capitals. Local government supplies public services θ to a population of N residents at the cost of $C\left(\theta, N\right)$.

The total expenditure is $EX(I_T, I_H, \theta) = I_T + I_H + C(\theta, N)$; the total fiscal revenue from mix VAT and APT tax source is $RV(I_T, I_H, \theta) = \tau_v Q_T + \tau_P P Q_H$. Hence, the balanced budget constraint is:

$$I_T + I_H + C(\theta, N) = \tau_v Q_T + \tau_p P Q_H \qquad (3.7)$$

3.1.5 The Equilibrium Outcomes

The three equilibrium conditions stated at the outset are restated as follows.

At equilibrium, the labor market is cleared with labor supply equal to the demand in both sectors:

$$L_T(P_X, r, W, Z_T) + L_H(P, r, W, Z_H) = N \qquad (3.8)$$

Hence, city size is affected by the net-of-tax product prices, the factor prices and the stock of local public capitals.

The non-traded goods market is cleared when the supply of non-traded goods meets the demand of non-traded goods. Given total non-traded goods demand is $q_H \cdot N$, and non-traded good supply is $F_H = F_H(P, r, W, Z_H)$, non-traded goods market clearing condition will be $q_H \cdot N = Q_H$. Given individual's non-traded goods demand is $q_H = q_H(P', W)$, the non-traded goods market clearing condition is restated as:

$$q_H(P', W) \cdot N = F_H(P, r, W, Z_H) \qquad (3.9)$$

Residents achieve location equilibrium when they receive the reservation utility:

$$V(P', W, \Theta) = U_0 \qquad (3.10)$$

These three conditions together can solve out equilibrium city performance in terms of the local wage rate, the non-traded goods price and the city size with respect to the local tax rates, the exogenous prices and the public goods.

$$P = P\left(\tau_v, \tau_P, 1, r, Z_T, Z_H, \Theta\right) \quad (3.11)$$

$$W = W\left(\tau_v, \tau_P, 1, r, Z_T, Z_H, \Theta\right) \quad (3.12)$$

$$N = N\left(\tau_v, \tau_P, 1, r, Z_T, Z_H, \Theta\right) \quad (3.13)$$

Note: The land market equilibrium is not discussed explicitly here, but simply assumed that it will adjust until equilibrium is achieved. Land tax is not included in the city performance, because it affects in the land market.

3.2 The Cobb-Douglas Specification

Glaeser and Gottlieb (2009) accounts for cross-city variations of housing rental price, wage rate and city size by local non-traded capitals and natural amenity in a spatial equilibrium model. Our study has a similar model setup as theirs, which also has the traded goods sector, the non-traded goods sector, and the households. In their model, the production and consumption activities are in a specific form of Cobb-Douglas. This specific formulation has the advantageous to analyze analytically the local non-traded capitals and natural amenity's impacts on city performance.

Their model has the two production sectors using inputs similar to ours: non-traded capital, private capital and labor.. However, we depart from their model in the interpretation of the two local non-traded capitals in the production functions. In their model, non-traded capital in traded goods production is simply a public capital other than land, while non-traded capital for non-traded goods production is suggested to be interpreted as land input. We reinterpreted the non-traded capitals in both sectors as closely related to land, which are seen as public capital investments to convert the agricultural

land to nonagricultural land for production uses. This interpretation of land as public capital investment is not seen often in the literature. For succinctness, the land input is suppressed in the production function and represented by the public capitals.

The household also consumes the three goods alike to ours, except the distinction that local amenity is referred only to natural amenity in their specification[6].

Besides these similarities and differences, one important extension of their study is that we add local governments, which endogenizes the local public capitals and public service provision.

The following restates the Glaeser and Gottlieb's model but modifications are made when necessary.

3.2.1 The Firm, the Builder and the Resident

Firm's production function is assumed to be Cobb-Douglas with constant return to scale with all inputs at the individual firm level given productivity: $f\left(z_{Tj}, k_{Tj}, l_{Tj}\right) = Az_{Tj}^{\alpha\gamma} k_{Tj}^{\alpha(1-\gamma)} l_{Tj}^{1-\alpha}$. The aggregate production function is:

$$F_T(Z_T, K_T, L_T) = AZ_T^{\alpha\gamma} K_T^{\alpha(1-\gamma)} L_T^{1-\alpha} \qquad (3.14)$$

Where

$A = aN^{\omega}$ Traded goods sector productivity with agglomeration economies N^{ω}

Z_T The public capital T input for traded goods production

K_T The private capital input for traded goods production

[6] In our model, local governments supply three public goods corresponding to the two non-traded capitals and the local amenities in Glaeser and Gottlieb's model: (1) public capital T for traded good production, (2) public capital H for housing service production, and (3) local amenities for resident's consumption.

L_T Labor input for traded goods production

α The capital share in traded goods production

$1-\alpha$ The labor share in traded goods production

γ The public capital share in total capital for traded production

$1-\gamma$ The private capital share in total capital for traded production

The aggregate traded goods revenue is:

$$P_X Q_T = P_X \cdot A Z_T^{\alpha\gamma} K_T^{\alpha(1-\gamma)} L_T^{1-\alpha} \quad (3.15)$$

The sector land rent from the traded goods sector is:

$$LR_T = \alpha\gamma \cdot (1-\tau_v) Q_T \quad (3.16)$$

The aggregate production function of non-traded goods is:

$$F_H\left(Z_H, K_H, L_H\right) = H Z_H^{\mu\eta} K_H^{\mu(1-\eta)} L_H^{1-\mu} \quad (3.17)$$

Where

H Non-traded goods sector productivity

Z_H The public capital H input for non-traded goods production

K_H The private capital input for non-traded goods production

L_H Labor input for non-traded goods production

μ The capital share in non-traded goods production

$1-\mu$ The labor share in non-traded goods production

η The public capital H share in total capital for non-traded production

$1-\eta$ The private capital share in total capital for non-traded production

The aggregate output of non-traded goods is:

$$PQ_H = P \cdot HZ_H^{\mu\eta} K_H^{\mu(1-\eta)} L_H^{1-\mu} \quad (3.18)$$

The non-traded sector land rent is:

$$LR_H = \mu\eta \cdot PQ_H \quad (3.19)$$

The resident's utility function is Cobb-Douglas:

$$U(\Theta, q_T, q_H) = \Theta q_T^{\beta} q_H^{1-\beta} \quad (3.20)$$

Where

$\Theta = \theta + \underline{\theta}$ Urban amenity consist of public service θ and natural amenity $\underline{\theta}$

q_T Traded goods consumption

q_H Non-traded goods consumption

β Household preference for traded goods consumption

The expenditure on traded goods consumption equals $q_T = \beta \cdot W$. The expenditure on non-traded goods subjected to property tax (τ_P) equals: $P' \cdot q_T = (1-\beta) \cdot W$, where P' is total-of-tax non-traded good rental price $P' = (1+\tau_P) \cdot P$. Residents have a reservation utility U_0 which is exogenous. The indirect utility is

$$V(P', W, \Theta) = \Theta \beta^{\beta} (1-\beta)^{1-\beta} W P'^{-(1-\beta)} \quad (3.21)$$

3.2.2 The City Government

(1) Government Utility

We add the local government's problem. The city government's utility function is Cobb-Douglas with a weight of υ on GDP and $1-\upsilon$ on quality of life:

$$U_g\left(GDP,\Theta\right)=GDP^{\upsilon}\cdot\Theta^{1-\upsilon} \qquad (3.22)$$

Where,

υ The weights assigned to GDP

GDP Gross Domestic Product

$\Theta=\theta+\underline{\theta}$ Urban amenity consist of public service θ and natural amenity $\underline{\theta}$

Eq.(3.6) The calculation of GDP is simplified with the specific form as

$$GDP=\left(1+\tau_P\right)PQ_H+Q_T \qquad (3.23)$$

(2) Budget Function

To specify the budget function, we need an assumption of the public service expenditure function.

Edwards(1990) provided a detailed analysis on the specification of the public goods congestion cost function. His study summarized 5 types of congestion function used in the literature: the decreasing marginal congestion, the increasing marginal congestion, the decreasing and increasing congestions depending on the parameter values, the generalized congestion function that encompasses that above three functions, and the last one further extends the fourth type to an unconditional one. Some studies, for example, Brueckner (2011), argues that the public service is perceived to have increasing shared

benefits for each individual when the city size is not in excess of the optimal size. On the other hand, exceeding that optimal level will induce congestions.

In this study, we adopt the specification of the public service congestion cost function as decreasing and increasing with respect to city size. This is different from the third and fourth model in Edwards's study, because we use a single function encompassing both the decreasing and increasing features, while his identifies these feature using subsection functions. The cost of providing the public service is:

$$C(\theta, N) = \theta^b e^{\varepsilon N} \qquad (3.24)$$

The public service θ is a one-time consumption good and subject to congestion. θ^b is the resource cost of producing public service, which indicates the production cost of θ by the private producer[7]. $e^{\varepsilon N}$ is the congestion induced by city size, while the city size depends on the tax regimes and public goods choice. ε denotes publicness of the public service. The higher value of ε, the lower publicness of the public service, because more congestion cost is induced. If $\varepsilon = 0$, then θ is a pure public good insulating from congestion cost; if $\varepsilon \neq 0$, then, the public service expenditure is subject to congestion.

According to the cost function of public service (Eq.(3.24)), the average cost of public service is $AC(\theta, N) = \frac{C(\theta, N)}{N} = \frac{\theta^b e^{\varepsilon N}}{N}$. The first order condition is:

$$\frac{dAC(\theta, N)}{dN} = AC(\theta, N) \cdot (\varepsilon - \frac{1}{N}) \qquad (3.25)$$

The second order condition is:

$$\frac{d^2 AC(\theta, N)}{dN^2} = AC(\theta, N) \frac{(\varepsilon^2 N^2 - 2\varepsilon N + 2)}{N^3} > 0 \qquad (3.26)$$

[7] It can assume that the public service production utilizes private capital inputs in the form: $\theta = K_\theta^{\frac{1}{b}}$, government pays private producer K_θ dollars: $K_\theta = \theta^b$.

Hence, the average cost of public service with respect to city size is a U-shape. The feature of the public service expenditure function is illustrated in Figure 3.1.

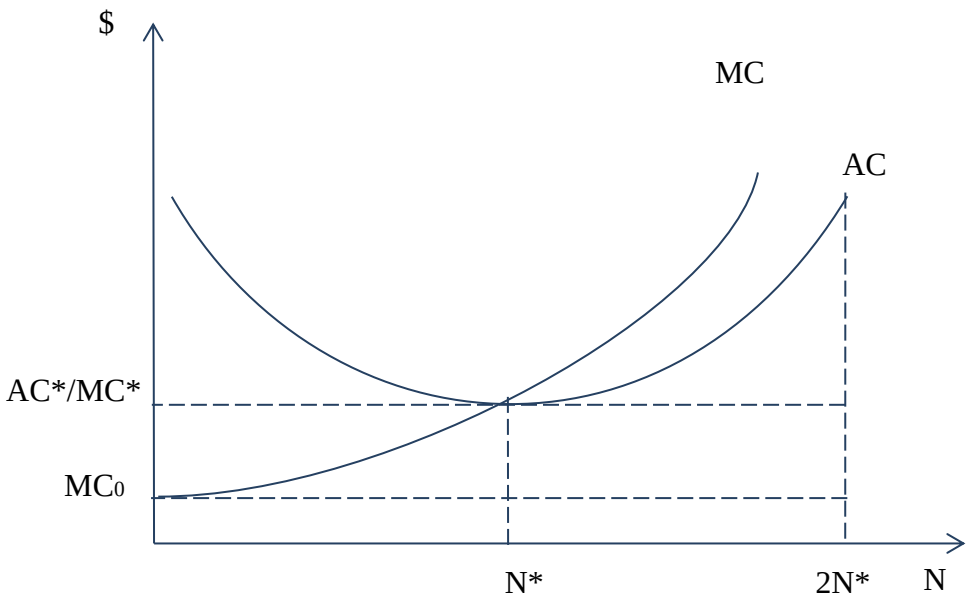

Figure 3.1 Minimum-average-cost city size

Note:

$N^* = 1/\varepsilon$ is the min-AC city size when MC=AC; $AC^* = MC^* = \theta^b e\varepsilon$ is the average cost and the marginal cost at min-AC city size; $MC_0 = \theta^b \varepsilon$ is the marginal cost at $N = 0$; the average cost at $2N^*$ is $\theta^b e^2 \varepsilon = e \cdot AC^* = 2.718 AC^*$

The marginal cost of the public service expenditure is $MC(\theta, N) = \theta^b e^{\varepsilon N} \varepsilon$. The minimum-average-cost (min-AC) city size is achieved at the marginal cost equals the average cost $N^* = \frac{1}{\varepsilon}$ (Figure 3.1). Therefore, the minimum average cost is $AC^* = AC(\theta, N^*) = \frac{\theta^b e^{\varepsilon N^*}}{N^*} = \theta^b e\varepsilon$. The marginal cost at min-AC city size N^* is $MC^* = MC(\theta, N^*) = \frac{dC(\theta, N)}{dN} = \theta^b e^{\varepsilon N^*} \varepsilon = \theta^b e\varepsilon$. The minimum marginal cost is achieved at no people living in the city $MC_0 = MC(\theta, 0) = \theta^b e^{\varepsilon N} \varepsilon = \theta^b \varepsilon$.

Figure 3.1 shows that the feasible area that provides incentive for government to increase public service expenditure is $N < N^*$, because within this range, the average cost is decreasing as city size increases, although the marginal cost increases; beyond this point, there will be disincentive for government to increase city size.

This implies that, a larger city size that exceeds the min-AC city size will induce congestion cost and cause disincentives for local government to provide public service.

After specifying the public service expenditure function, the explicit budget function is

$$I_T + I_H + \theta^b \cdot e^{\varepsilon \cdot N} = \tau_v Q_T + \tau_p P Q_H \qquad (3.27)$$

3.2.3 The Equilibrium Outcomes

Using the above specified Cobb-Douglas functions, the equilibrium city performance is obtained as follows,

$$\ln(W) = \kappa_W + \underline{\tau}_W + \lambda_A^W \ln\left(aZ_T^{\alpha\gamma}\right) + \lambda_H^W \ln\left(HZ_H^{\mu\eta}\right) + \lambda_\theta^W \ln(\Theta) \qquad (3.28)$$

$$\ln(P) = \kappa_P + \underline{\tau}_P + \lambda_A^P \ln\left(aZ_T^{\alpha\gamma}\right) + \lambda_H^P \ln\left(HZ_H^{\mu\eta}\right) + \lambda_\theta^P \ln(\Theta) \qquad (3.29)$$

$$\ln(N) = \kappa_N + \underline{\tau}_N + \lambda_A^N \ln\left(aZ_T^{\alpha\gamma}\right) + \lambda_H^N \ln\left(HZ_H^{\mu\eta}\right) + \lambda_\theta^N \ln(\Theta) \qquad (3.30)$$

Eq.(3.28), (3.29) and (3.30) report the equilibrium local wage rate, rental price and city size respectively. κ_W, κ_P and κ_N are constant terms which depend on the parameters in the production function and household preferences[8]. It shows that in contrast with Glaeser and Gottlieb, local wage rate, rental price,

[8] κ_W, κ_P and κ_N are different from Glaeser and Gottlieb (2009) without having the term $\lambda_A^N \ln\left(1-(1-\mu)(1-\beta)\right)^{-\alpha\gamma}$, $\lambda_A^W \ln\left(1-(1-\mu)(1-\beta)\right)^{-\alpha\gamma}$ and $\lambda_A^P \ln\left(1-(1-\mu)(1-\beta)\right)^{-\alpha\gamma}$ because they are included in the tax terms. The analysis won't be affected with these differences.

and city size depend on the two public capitals (z_T and z_H), the public service ($\theta = \Theta - \underline{\theta}$), and three tax terms($\underline{\tau}_W$, $\underline{\tau}_P$, and $\underline{\tau}_N$). The coefficients of the last three terms on the right hand side of each equation shows the productivity shock (λ_A^W, λ_A^P, λ_A^N), the housing supply shock (λ_H^W, λ_H^P, λ_H^N), and the amenity shock (λ_θ^W, λ_θ^P, λ_θ^N) on city performances, which are presented in Table 3.1.

Table 3.1 Spatial equilibrium city performance

Equation parameters	Value of parameters with agglomeration economies
λ_A^N	$\dfrac{\beta+\mu(1-\beta)(1-\eta)}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$
λ_H^N	$\dfrac{(1-\alpha+\alpha\gamma)(1-\beta)}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$
λ_θ^N	$\dfrac{1-\alpha+\alpha\gamma}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$
λ_A^W	$\dfrac{\mu\eta(1-\beta)}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$
λ_H^W	$\dfrac{-(1-\beta)(\alpha\gamma-\omega)}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$
λ_θ^W	$\dfrac{-(\alpha\gamma-\omega)}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$
λ_A^P	$\dfrac{\mu\eta}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$
λ_H^P	$\dfrac{-(\alpha\gamma-\omega)}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$
λ_θ^P	$\dfrac{(1-\alpha+\omega)\mu\eta-(1-\mu)(\alpha\gamma-\omega)}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$

The effects of these three shocks are the same as that in Glaeser and Gottlieb, which are stated in the follows.

(1) The Productivity Shock

Under the condition of diseconomies bigger than agglomeration economies ($\alpha\gamma > \omega$), the productivity shock has positive effects on all city performances: local wage rate ($\lambda_A^W > 0$), rental price ($\lambda_A^P > 0$), and city size ($\lambda_A^N > 0$), because the productivity shock increases the labor productivity and attracts more movements of labor into the city, which drives up the housing rental price until the housing rental price is high enough to offset the benefit from higher labor productivity.

(2) The Housing Supply Shock

The housing supply shock depresses housing price ($\lambda_H^P < 0$), local wage rate ($\lambda_H^W < 0$), but enhances city size ($\lambda_H^N > 0$), because more housing supply undermines the housing rental price, which increases the welfare of resident as the consumption possibility frontier is expanded; hence, more immigrants are attracted into the city, which decreases the marginal product of labor and cause it to move until their utility has been restored to the reservation level.

(3) The Amenity Shock

Local amenities shock increases housing prices ($\lambda_\theta^P > 0$) and city size ($\lambda_\theta^N > 0$), but depresses the local wage rate ($\lambda_\theta^W < 0$), because better local amenities will attract more people, who will "bid" up the housing rental price; whereas, more labor supply will depress the marginal product of labor.

Chapter 4 The Effect of Taxes on Equilibrium Outcome and Public Expenditure Choice

The tax effects on city performances, including local wage rate, housing rental price and city size, are discussed analytically in this chapter. The specific Cobb-Douglas form of the theoretical model allows us to analytically identify the direct tax effects. This comparative static analysis can provide some useful insights on how VAT affects differently the city performances in comparison to APT by disentangling the effects from public goods. We also extend the analysis to the equilibrium traded and non-traded good outputs and land rents.

In addition, this chapter investigates local government's public goods choice incentive by examining the budget constraint and the government objectives, separately. The tax incentive is examined by fixing the government's preference, while the incentive of government objective is analyzed by fixing the budget constraint to the VAT regime. The production possibility frontier (PPF) of the balanced budget is investigated to explore the incentive of different tax regimes. The government's preference effect is to be examined via its utility using similar approach.

4.1 Taxes and Housing Rental Price, Wage and City Size

The tax terms in Eq. (3.28), (3.29) and (3.30) are:

$$\underline{\tau}_X = \lambda_A^X(-\alpha\gamma)\cdot\ln\left[1-\frac{(1-\mu)(1-\beta)}{1+\tau_p}\right]+\left[\lambda_H^X\mu\eta-\lambda_\theta^X(1-\beta)\right]\cdot\ln(1+\tau_p)+\lambda_A^X\cdot\ln(1-\tau_v)$$
$$(\mathrm{X}=\mathrm{W},\mathrm{P},\mathrm{N})$$

(4.1)

As shown in Eq.(4.1), the effect of VAT on city performance depends solely on the productivity shocks (λ_A^X) while the effect of property tax is interactive with the amenity shock (λ_θ^X), productivity shock (λ_A^X), and the housing supply shock (λ_H^X), which are illustrated in the following matrix:

$$\frac{\partial(\ln(W),\ln(P),\ln(N))}{\partial(\tau_v,\tau_P)} = \frac{\partial(\underline{\tau}_W,\underline{\tau}_P,\underline{\tau}_N)}{\partial(\tau_v,\tau_P)}$$

$$= \begin{bmatrix} \lambda_A^W & \lambda_H^W \mu\eta & \lambda_\theta^W (1-\beta) \\ \lambda_A^P & \lambda_H^P \mu\eta & \lambda_\theta^P (1-\beta) \\ \lambda_A^N & \lambda_H^N \mu\eta & \lambda_\theta^N (1-\beta) \end{bmatrix} \cdot \begin{bmatrix} \frac{d\ln(1-\tau_v)}{d\tau_v} & (-\alpha\gamma)\cdot\frac{d\ln\left[1-\frac{(1-\mu)(1-\beta)}{1+\tau_p}\right]}{d\tau_P} \\ 0 & \frac{d\ln(1+\tau_p)}{d\tau_P} \\ 0 & -\frac{d\ln(1+\tau_p)}{d\tau_P} \end{bmatrix}$$

$$= \begin{bmatrix} + & - & - \\ + & - & + \\ + & + & + \end{bmatrix} \cdot \begin{bmatrix} - & - \\ 0 & + \\ 0 & - \end{bmatrix} = \begin{bmatrix} - & + \\ - & - \\ - & - \end{bmatrix}$$

(4.2)

The middle term of the equation (between the second and the third equal marks) shows the interaction of the tax effects with the three shocks. The outcomes of the interactions are shown in the last term. The first column matric of the last term presents the effects of VAT on local wage rate, house rent, and city size orderly. The second column matric depicts the APT's effects.

4.1.1 VAT Effects

The effect of VAT is negative on housing rental price, local wage rate and city size. Figure 4.1 diagrammatically exposes this effect.

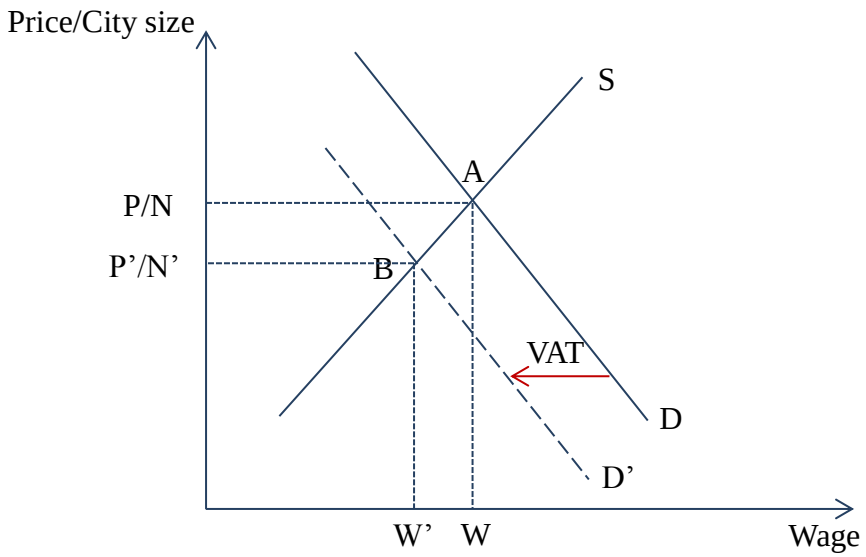

Figure 4.1 VAT and housing rental price, wage, and city size

Note:
The labor demand curve D and the labor supply curve S intersect at A, which is the original city status in terms of housing rental price, city size and wage rate at P, N, and W. As VAT is imposed, labor demand curve shifts to the left and the new labor market equilibrium is achieved at B, which decreases the housing rental price, city size and wage rate to P', N', and W'.

Figure 4.1 shows that VAT decreases the local wage rate, the housing rental price and the city size. The intuition is that given public goods, VAT acts as a negative external shock, which decreases the return of traded goods output. This output effect instantly induces a lower marginal product of labor in the traded goods sector; consequently, labor will move to a local non-traded goods sector. As the labor supply to the non-traded goods sector increases, the marginal product of labor in the non-traded goods sector decreases while that (the total-of-tax wage rate) in the traded goods sector increases; this movement will stop when the wage rates in the two sectors are equal. At equilibrium, the wage rate is reduced relative to the no-tax equilibrium. From a production cost's point of view, the labor cost has to decrease in order to breakeven, given that the competitive rate of return of private capital is exogenous.

From the demand side, as the local wage rate decreases, households will in response consume less housing services as well as traded goods. As a result,

housing rental prices will decrease and the housing developer must adjust by employing less factor inputs until it receives the competitive rate of return of private capital. Since the labor demand is decreased in both traded goods sector and non-traded goods sector, the city size will shrink. An alternative interpretation is that housing rental prices must decrease with the reduction of local wage rate in order to maintain the exogenous reservation utility in this small open-economies framework.

4.1.2 APT Effects

The residential property tax has negative effects on housing rental price and city size, but positive on local wage rate. Figure 4.2 diagrammatically explores these effects.

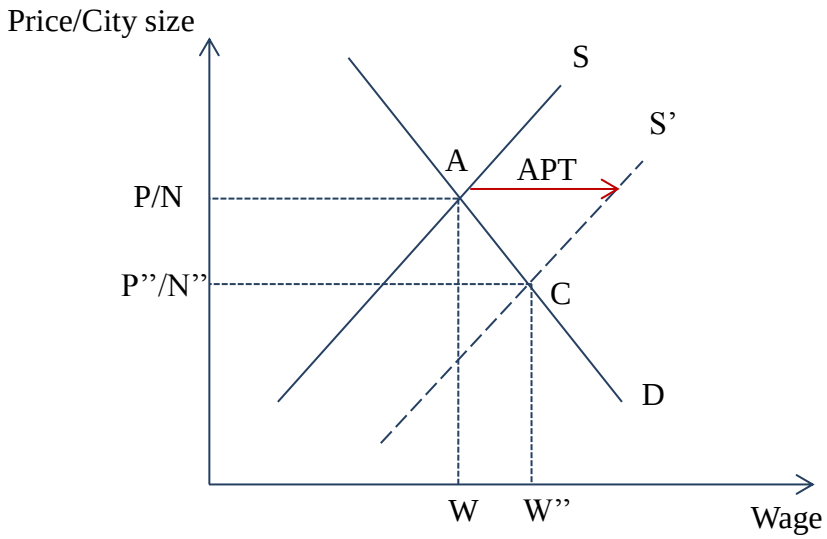

Figure 4.2 APT and housing rental price, wage and city size

Note:
The labor demand curve D and the labor supply curve S intersect at A, which is the original city status in terms of housing rental price, city size and wage rate at P, N, and W. As APT is imposed, labor supply curve shifts to the right and the new labor market equilibrium is achieved at C, which decreases the housing rental price and city size to P'' and N'', but increases wage rate to W''.

For residential property tax, its effect on housing rental price and city size is negative. The effect on local wage rate is positive. The property tax acts as a negative labor supply shock, which increases the total-of-tax price of housing service. The cost of living is then increased and will drive out the resident workers since the reservation utility can be obtained elsewhere. Consequently, the city size will be reduced and the demand for housing service is depressed.

As labor supply decreases, the marginal product of labor will increase. As the total demand for housing service decreases due to the higher total-of-tax housing price, the market price of housing service (net-of-tax housing rental price) will also decline.

The labor outflow will not terminate until local wage rate increases enough to compensate for the total-of-tax housing rental price in order to restore the reservation utility. Hence, equilibrium is achieved at a smaller city size, higher local wage rate, and lower net-of-tax housing rental price, despite the total-of-tax housing rental price being higher than the initial rental price when no tax is imposed.

Claim #1 *VAT decreases local wage rate, housing rental price and city size; residential property tax decreases housing rental price and city size, but increases local wage rate.*

4.1.3 Taxes and Sector Outputs

After obtaining the equilibrium city profile, the equilibrium traded and non-traded good outputs: Q_T and PQ_H can be obtained as follows:

$$\ln\left(Q_T\right)=\kappa_{QT}+\underline{\tau}_{QT}+\lambda_A^B\ln\left(aZ_T^{\alpha\gamma}\right)+\lambda_H^B\ln\left(HZ_H^{\mu\eta}\right)+\lambda_\theta^B\ln\left(\Theta\right) \qquad (4.3)$$

$$\ln\left(PQ_H\right)=\kappa_{PQ}+\underline{\tau}_{PQ}+\lambda_A^B\ln\left(aZ_T^{\alpha\gamma}\right)+\lambda_H^B\ln\left(HZ_H^{\mu\eta}\right)+\lambda_\theta^B\ln\left(\Theta\right) \qquad (4.4)$$

Where,

$$\underline{\tau}_{QT} = -\frac{1-\alpha}{\alpha\gamma}\underline{\tau}_W + \frac{\omega}{\alpha\gamma}\underline{\tau}_N + \frac{1-\alpha\gamma}{\alpha\gamma}\ln(1-\tau_v)$$

$$\underline{\tau}_{PQ} = \frac{1}{\mu\eta}\underline{\tau}_P - \frac{1-\mu}{\mu\eta}\underline{\tau}_W$$

$$\lambda_A^B = \frac{\mu+\beta-\mu\beta}{M}, \lambda_H^B = \frac{(1-\beta)(1-\alpha+\omega)}{M}, \lambda_\theta^B = \frac{1-\alpha+\omega}{M}$$

$$M = (1-\alpha+\omega)(1-\beta)\mu\eta + (\mu+\beta-\mu\beta)(\alpha\gamma-\omega)$$

Eq.(4.3)-(4.4) show that the two equilibrium outputs also depend on the production technology, resident-worker's preferences, the tax regimes, and the three public expenditures, which exhibit a similar form to that of city size, local wage rate, and housing rental price. The marginal effect of each public good on traded goods output (or the VAT tax base) is detected to be equal to the non-traded goods output (or the APT tax base): the marginal effect of public capital T equals $\lambda_A^B\alpha\gamma$, public capital H is $\lambda_H^B\mu\eta$, and public service is λ_θ^B, which indicates that given exogenous tax rates, the relative size of the tax bases is independent of the public goods mix and proportionally fixed. It implies that the incentive for public good choices derived from VAT does not differ from APT in terms of each public good's marginal effects on tax revenues. The intuition is that the freely mobile capital and labor will ensure the equalization of marginal benefit of each public good across sectors when it reaches equilibrium.

Therefore, the major distinctions of the two outputs depend on the tax regimes as well as the production technology and household preference, which are presented in the constant terms.

The following analyses of this section will investigate the direct effect of the taxes on the traded and non-traded goods output, land rent, and their ratio.

(1) Taxes and Traded Goods Output

From Eq.(4.3) and Eq.(4.4), the marginal tax effect on traded and non-traded

goods output with respect to VAT, respectively,

$$\begin{aligned}\frac{\partial \ln(Q_T)}{\partial \tau_v} &= \frac{\partial \underline{\tau}_{QT}}{\partial \tau_v} = -\frac{1-\alpha}{\alpha\gamma}\cdot\frac{\partial \underline{\tau}_W}{\partial \tau_v} + \frac{\omega}{\alpha\gamma}\cdot\frac{\partial \underline{\tau}_N}{\partial \tau_v} + \frac{1-\alpha\gamma}{\alpha\gamma}\cdot\frac{\partial \ln(1-\tau_v)}{\partial \tau_v} \\ &= -\frac{1-\alpha}{\alpha\gamma}\cdot\left(-\lambda_A^W\right)\cdot\frac{1}{1-\tau_v} + \frac{\omega}{\alpha\gamma}\cdot\left(-\lambda_A^N\right)\cdot\frac{1}{1-\tau_v} - \frac{1-\alpha\gamma}{\alpha\gamma}\cdot\frac{1}{1-\tau_v} \\ &= \left[-\frac{1-(1-\mu)(1-\beta)}{M}+1\right]\cdot\frac{1}{1-\tau_v}\end{aligned} \qquad (4.5)$$

$$\begin{aligned}\frac{\partial \ln(PQ_H)}{\partial \tau_v} &= \frac{\partial \underline{\tau}_{PQ}}{\partial \tau_v} = \frac{1}{\mu\eta}\cdot\frac{\partial \underline{\tau}_P}{\partial \tau_v} - \frac{1-\mu}{\mu\eta}\cdot\frac{\partial \underline{\tau}_W}{\partial \tau_v} \\ &= \frac{1}{\mu\eta}\cdot\left(-\lambda_A^P\right)\cdot\frac{1}{1-\tau_v} - \frac{1-\mu}{\mu\eta}\cdot\left(-\lambda_A^W\right)\cdot\frac{1}{1-\tau_v} \\ &= -\frac{1-(1-\mu)(1-\beta)}{M}\cdot\frac{1}{1-\tau_v}\end{aligned} \qquad (4.6)$$

Since the constant terms in Eq.(4.5) (Appendix A for proof) and (4.6) are negative: $-\frac{1-(1-\mu)(1-\beta)}{M}+1<0$ and $-\frac{1-(1-\mu)(1-\beta)}{M}<0$, VAT has negative effects on both traded and non-traded good outputs.

(2) Taxes and Non-traded Goods Output

From Eq.(4.3) and Eq.(4.4), the APT effects on traded and non-traded good output is

$$\begin{aligned}\frac{\partial \ln(Q_T)}{\partial \tau_p} &= \frac{\partial \underline{\tau}_{QT}}{\partial \tau_p} = -\frac{1-\alpha}{\alpha\gamma}\cdot\frac{\partial \underline{\tau}_W}{\partial \tau_p} + \frac{\omega}{\alpha\gamma}\cdot\frac{\partial \underline{\tau}_N}{\partial \tau_p} \\ &= -\frac{1-\alpha}{\alpha\gamma}\cdot\left[\lambda_A^W\cdot(-\alpha\gamma)\cdot\frac{(1-\mu)(1-\beta)}{1+\tau_p-(1-\mu)(1-\beta)} + \lambda_H^W\mu\eta - \lambda_\theta^W(1-\beta)\right]\cdot\frac{1}{1+\tau_p} \\ &\quad + \frac{\omega}{\alpha\gamma}\cdot\left[\lambda_A^N\cdot(-\alpha\gamma)\cdot\frac{(1-\mu)(1-\beta)}{1+\tau_p-(1-\mu)(1-\beta)} + \lambda_H^N\mu\eta - \lambda_\theta^N(1-\beta)\right]\cdot\frac{1}{1+\tau_p} \\ &= \left[-\frac{1}{\alpha\gamma}+\frac{1-(1-\mu)(1-\beta)}{M}\right]\cdot(-\alpha\gamma)\cdot\frac{(1-\mu)(1-\beta)}{1+\tau_p-(1-\mu)(1-\beta)}\cdot\frac{1}{1+\tau_p} \\ &\quad + \frac{(1-\alpha+\omega)(1-\beta)}{M}\cdot\mu\eta\cdot\frac{1}{1+\tau_p} \\ &\quad - \frac{1-\alpha+\omega}{M}\cdot(1-\beta)\cdot\frac{1}{1+\tau_p}\end{aligned} \qquad (4.7)$$

$$\begin{aligned}\frac{\partial \ln(PQ_H)}{\partial \tau_p} &= \frac{\partial \underline{\tau}_{PQ}}{\partial \tau_p} = \frac{1}{\mu\eta}\cdot\frac{\partial \underline{\tau}_P}{\partial \tau_p} - \frac{1-\mu}{\mu\eta}\cdot\frac{\partial \underline{\tau}_W}{\partial \tau_p} \\ &= \frac{1}{\mu\eta}\cdot\left[\lambda_A^P\cdot(-\alpha\gamma)\cdot\frac{(1-\mu)(1-\beta)}{1+\tau_p-(1-\mu)(1-\beta)} + \lambda_H^P\mu\eta - \lambda_\theta^P(1-\beta)\right]\cdot\frac{1}{1+\tau_p} \\ &\quad -\frac{1-\mu}{\mu\eta}\cdot\left[\lambda_A^W\cdot(-\alpha\gamma)\cdot\frac{(1-\mu)(1-\beta)}{1+\tau_p-(1-\mu)(1-\beta)} + \lambda_H^W\mu\eta - \lambda_\theta^W(1-\beta)\right]\cdot\frac{1}{1+\tau_p} \\ &= \frac{1-(1-\mu)(1-\beta)}{M}\cdot(-\alpha\gamma)\cdot\frac{(1-\mu)(1-\beta)}{1+\tau_p-(1-\mu)(1-\beta)}\cdot\frac{1}{1+\tau_p} \\ &\quad +\left[-\frac{1}{\mu\eta}+\frac{(1-\alpha+\omega)(1-\beta)}{M}\right]\cdot\mu\eta\cdot\frac{1}{1+\tau_p} \\ &\quad -\frac{1-\alpha+\omega}{M}\cdot(1-\beta)\cdot\frac{1}{1+\tau_p}\end{aligned} \quad (4.8)$$

Both outputs are negatively related to APT. These findings are similar to that with respect to VAT.

(3) The Non-traded to Traded Goods Output Ratio

Since the marginal effects of each public good on non-traded goods are the same as those on traded goods, the ratio of the non-traded goods to traded goods depends on only the tax regimes and the production technology and the household preference, denoting the ratio as

$$\ln\phi(\tau_v,\tau_P) = \ln(PQ_H) - \ln(Q_T) = (\kappa_{PQ}+\underline{\tau}_{PQ}) - (\kappa_{QT}+\underline{\tau}_{QT}) \quad (4.9)$$

Then, the non-traded to traded goods output ratio is

$$\phi(\tau_v,\tau_P) = \frac{PQ_H}{Q_T} = (1-\alpha)(1-\beta)\frac{1-\tau_v}{1+\tau_P-(1-\mu)(1-\beta)} \quad (4.10)$$

The marginal tax effect on the non-traded to traded goods output ratio under VAT regime ($\tau_v > 0, \tau_P = 0$) is

$$\frac{\partial\phi(\tau_v,0)}{\partial\tau_v} = (1-\alpha)(1-\beta)\frac{-1}{1-(1-\mu)(1-\beta)} < 0 \quad (4.11)$$

Eq.(4.11) shows that the non-traded to traded goods output ratio is decreasing with VAT, which implies that VAT decreases non-traded goods output faster than that of traded goods output. Hence, the non-traded goods sector is more impacted by taxation than the traded goods sector. According to the tax incidence theory, the tax burden is higher for the less mobile sectors (factors). The non-traded goods sector, which is less mobile than the traded sector, will bare more of the tax burden.

The marginal tax effect on the non-traded to traded goods output ratio under APT regime ($\tau_v = 0, \tau_P > 0$) is

$$\frac{\partial \phi(0,\tau_P)}{\partial \tau_P} = (1-\alpha)(1-\beta)\frac{-1}{\left[1+\tau_P-(1-\mu)(1-\beta)\right]^2} < 0 \qquad (4.12)$$

From Eq.(4.12), it is evident that the non-traded to traded goods output ratio is decreasing with APT. The reasoning is similar as that with respect to VAT: the non-traded goods sector is more affected by taxation than traded goods sector.

Despite that both VAT and APT decrease the non-traded goods output more than the traded goods output, the relative strength of the tax effects on the output ratio is ambiguous $\frac{1}{1-(1-\mu)(1-\beta)} > or < \frac{1}{\left[1+\tau_P-(1-\mu)(1-\beta)\right]}$, because the VAT effects on the non-traded to traded goods ratio is at a constant rate, while the APT effects vary with the initial tax level.

At a higher level of initial APT, the marginal effect of the ratio with respect to APT is lower. In this case, the APT will decrease the non-traded to traded goods output ratio at a lower rate $\frac{1}{1-(1-\mu)(1-\beta)} > \frac{1}{\left[1+\tau_P-(1-\mu)(1-\beta)\right]}$.

When the initial APT equals zero, the APT decreases the non-traded to traded goods output ratio at the fastest rate. In this circumstance, the marginal VAT effect is smaller than that APT $\frac{1}{1-(1-\mu)(1-\beta)} < \frac{1}{\left[1+\tau_V-(1-\mu)(1-\beta)\right]}$, hence the APT depresses the non-traded goods more than the traded goods output.

Claim #2 *Given public goods, both VAT and APT have negative impacts on traded and non-traded goods outputs. The ratio of the non-traded to traded goods outputs is independent of the public good mix in the city, but is negatively related to both VAT and APT.*

4.1.4 Taxes and Land Rents

(1) Taxes and Traded, Non-traded Land Rents

From Eq.(3.16) and Eq.(3.19), the marginal tax effect of VAT on traded and non-traded land rent, respectively, is

$$\frac{\partial \ln(LR_T)}{\partial \tau_v} = \frac{\partial \ln(\alpha\gamma \cdot (1-\tau_v) Q_T)}{\partial \tau_v} = -\frac{1}{1-\tau_v} + \left[-\frac{1-(1-\mu)(1-\beta)}{M} + 1 \right] \cdot \frac{1}{1-\tau_v} = \frac{1-(1-\mu)(1-\beta)}{M} \cdot \frac{-1}{1-\tau_v} \quad (4.13)$$

$$\frac{\partial \ln(LR_H)}{\partial \tau_v} = \frac{\partial \ln(\mu\eta \cdot PQ_H)}{\partial \tau_v} = \frac{1-(1-\mu)(1-\beta)}{M} \cdot \frac{-1}{1-\tau_v} \quad (4.14)$$

Eq.(4.13) shows that VAT affects the traded sector land rent through the direct effect as well as the indirect effect which acts through traded goods output. Eq.(4.14) shows that VAT affects the non-traded land rent mainly by its indirect effect on non-traded goods output, where the direct effect does not play a role. The results show that the marginal effect of VAT on traded land rent is equal to that on non-traded land rent. This implies that VAT decreases the traded and non-traded land rent at the same rate.

The marginal tax effect on traded and non-traded land rent under the APT regime, respectively, is

$$\frac{\partial \ln(LR_T)}{\partial \tau_P} = \frac{\partial \ln(\alpha\gamma \cdot Q_T)}{\partial \tau_P} = \frac{\partial \ln(Q_T)}{\partial \tau_P} \quad (4.15)$$

$$\frac{\partial \ln\left(LR_H\right)}{\partial \tau_P} = \frac{\partial \ln(\mu\eta \cdot PQ_H)}{\partial \tau_P} = \frac{\partial \ln(PQ_H)}{\partial \tau_P} \qquad (4.16)$$

Eq.(4.15) and Eq.(4.16) show that the marginal tax effect of APT on the sector land rent is due to the indirect effect via its effect on the traded and non-traded goods output. From Claim#2, APT has negative impacts on both traded and non-traded goods output; it indicates that their land rents are decreased by APT.

(2) The Non-traded to Traded Land Rent Ratio

The non-traded land rent to traded land rent equals

$$\frac{LR_H}{LR_T} = \frac{\mu\eta \cdot PQ_H}{\alpha\gamma \cdot (1-\tau_v) Q_T} = \frac{\mu\eta}{\alpha\gamma \cdot (1-\tau_v)} \cdot \phi(\tau_v, \tau_P) = \frac{\mu\eta}{\alpha\gamma} \cdot \frac{(1-\alpha)(1-\beta)}{1+\tau_P - (1-\mu)(1-\beta)} \qquad (4.17)$$

Therefore, the ratio of non-traded to traded land rent is not affected by VAT but instead decreased with APT.

Claim #3 *Given public goods, both VAT and APT depress traded and non-traded sector's land rents, but the ratio of non-traded to traded land rent is not affected by VAT despite being negatively related to APT.*

4.2 Taxes and the Choice of Public Investment and Service Spending under Balanced Budget

The expenditure on public service is $C(\theta, N) = \theta^b e^{\varepsilon N}$. The marginal cost of the public service provision and its average cost have the following relationship:

$$MC(\theta, N) = AC(\theta, N) \cdot \varepsilon N \qquad (4.18)$$

Using that relationship, linearizing the public service expenditure at the base city size (N_0) yields[9]:

$$\begin{aligned} C(\theta, N) &\approx AC(\theta, N_0)\cdot N + (MC(\theta, N_0) - AC(\theta, N_0))\cdot \Delta N \\ &= AC(\theta, N_0)\cdot N + AC(\theta, N_0)(\varepsilon N_0 - 1)\cdot \Delta N \end{aligned} \qquad (4.19)$$

Hence, Eq.(4.19) shows that the public service expenditure consists of (i) the resource cost of supplying total city population with public service $AC(\theta, N_0)\cdot N$, and (ii) the incremental congestion cost as a result from increased city size $AC(\theta, N_0)(\varepsilon N_0 - 1)\cdot \Delta N$. Furthermore, εN_0 equals $\frac{N_0}{N^*}$ by applying the min-AC city size for supplying public service $N^* = \frac{1}{\varepsilon}$. Therefore, $\varepsilon N_0 - 1 = \frac{N_0 - N^*}{N^*}$ measures the congestion level, as shown in the difference between AC curve and MC curve in Figure 3.1.

If $\varepsilon N_0 - 1 = 0$, then the initial city size is at a min-AC level, no congestion cost will be induced as the city size increases. If $\varepsilon N_0 - 1 < 0$, then the city size is too small in comparison to the min-AC level, and the scale economies are under explored; if $\varepsilon N_0 - 1 > 0$, then the city size is too large relative to the min-AC city size which induces the congestion.

To illustrate the opportunity cost of supplying public service in terms of sacrificing public capitals under different tax regimes, we linearize the balanced budget using Eq.(3.28)-(3.30). The linearized balanced budget equation can be stated as,

---

[9] $$\begin{aligned} C(\theta, N) &\approx C(\theta, N_0) + \frac{\partial C(\theta, N)}{\partial N}\cdot \Delta N \\ &= AC(\theta, N_0)\cdot N_0 + MC(\theta, N_0)\cdot \Delta N \\ &= AC(\theta, N_0)\cdot N + (MC(\theta, N_0) - AC(\theta, N_0))\cdot \Delta N \\ &= AC(\theta, N_0)\cdot N + AC(\theta, N_0)(\varepsilon N_0 - 1)\cdot \Delta N \end{aligned}$$

$$\begin{aligned} RV_0 - C(\theta_0, N_0) = & (Z_{T0} + C(\theta_0, N_0) \cdot \varepsilon N_0 \cdot \lambda_A^N \alpha\gamma - RV_0 \lambda_A^B \alpha\gamma) \dot{Z_T} \\ & + (Z_{H0} + C(\theta_0, N_0) \cdot \varepsilon N_0 \cdot \lambda_H^N \mu\eta - RV_0 \lambda_H^B \mu\eta) \dot{Z_H} \\ & + (C(\theta_0, N_0) \cdot b + C(\theta_0, N_0) \cdot \varepsilon N_0 \cdot \lambda_\theta^N \frac{\theta_0}{\theta_0 + \underline{\theta}} - RV_0 \lambda_\theta^B \frac{\theta_0}{\theta_0 + \underline{\theta}}) \dot{\theta} \end{aligned} \quad (4.20)$$

Dividing both sides of the balanced budget equation (Eq.(4.20)) with initial revenue RV_0 yields,

$$\begin{aligned} 1 - a_1 = & (a_2 + a_1 a_4 \cdot \lambda_A^N \alpha\gamma - \lambda_A^B \alpha\gamma) \dot{Z_T} \\ & + (a_3 + a_1 a_4 \cdot \lambda_H^N \mu\eta - \lambda_H^B \mu\eta) \dot{Z_H} \\ & + (a_1 \cdot b + a_1 a_4 \cdot \lambda_\theta^N \frac{\theta_0}{\theta_0 + \underline{\theta}} - \lambda_\theta^B \frac{\theta_0}{\theta_0 + \underline{\theta}}) \dot{\theta} \end{aligned} \quad (4.21)$$

Where,

$a_1 \equiv \frac{C(\theta_0, N_0)}{RV_0}$ The share of initial public service expenditure in initial tax revenue

$a_2 \equiv \frac{Z_{T0}}{RV_0}$ The share of initial public capital T stock in initial tax revenue

$a_3 \equiv \frac{Z_{H0}}{RV_0}$ The share of initial public capital H stock in initial tax revenue

$a_4 \equiv \varepsilon N_0$ The congestion level $a_4 - 1$

Eq.(4.21) determines the opportunity cost of the public service expenditure in terms of sacrificing public capital. a_1 is the share of the initial public service expenditure in fiscal revenue and $a_4 - 1$ represents the congestion level, while a_2 and a_3 are the initial public capital T and H stock share in initial fiscal revenue respectively. It shows that a_2 and a_3 are not affected by the changing of the tax regime with the equivalent initial revenue approach, while a_1 and a_4 vary with the tax regime via the city size.

In the left hand side of Eq.(4.21), $1 - a_1$ shows the initial fiscal surplus, which

varies with different tax regimes. This represents the income effects of taxation. The different tax regimes are also reflected in the right hand side of Eq.(4.21) in a_4. This shows the substitution effects of taxation. As the income effect scales the public capitals and public services at the same rate, the major mechanism shifts local government's incentive between public capitals and public service is determined by the substitution effects. This is depicted in Figure 4.3.

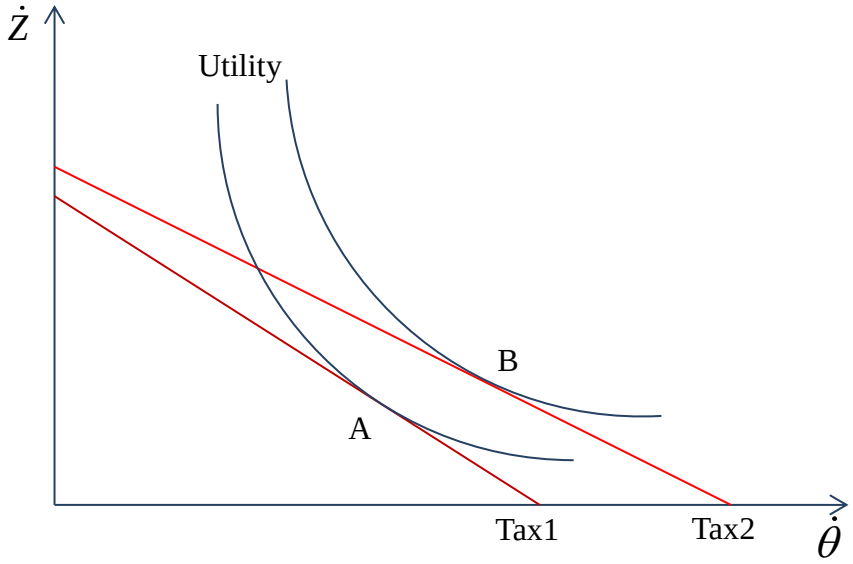

Figure 4.3 The PPF shifts with different tax regimes

Note:

Under the Tax1 regime, local government's public goods choice is A; under the Tax2 regime, the choice is B. Tax1 has a smaller PPF(Production Possibility Frontier) than Tax2 due to the larger city size with Tax1 than with Tax2. The substitution effect of Tax1 causes government to spend more on public capital investment than public service, as opposing to Tax2.

There are two different tax regimes: Tax1 and Tax2. Assuming Tax1 has a larger city size than Tax2, Tax1 has a steeper PPF than Tax2 under the condition of the equivalent initial tax revenues, as shown in Figure 4.3. The substitution effect incentivizes local government to choose more public capital investment rather than public service provision with Tax1 in comparison to Tax2, because a higher opportunity cost of public service provision in terms of

sacrificing public capital is associated with a larger city size.

Claim #4 *The opportunity cost of supplying public service in terms of sacrificing public capital is higher with a larger city size.*

4.3 The Government Preference and the Choice of Public Investment and Service Spending

Local government's utility function can be restated in ln form as follows:

$$\ln\left(U_g\right) = \upsilon \cdot \ln\left(GDP\right) + \left(1-\upsilon\right) \cdot \ln\left(\Theta\right), \ \left(\Theta=\theta+\underline{\theta}\right) \qquad (4.22)$$

According to Eq.(3.23) and Eq.(4.10), GDP can be restated as

$$GDP = \left(1+\tau_P\right) \cdot PQ_H + Q_T = \left[\left(1+\tau_P\right)\cdot\phi\left(\tau_V,\tau_P\right)+1\right] \cdot Q_T \qquad (4.23)$$

From Eq.(4.22) and Eq.(4.23), the marginal rate of substitution between public capital Z_T and public service θ:

$$\frac{\dot{Z}_T}{\dot{\theta}} = \frac{\partial \ln\left(U_g\right)/\partial \ln\left(\theta\right)}{\partial \ln\left(U_g\right)/\partial \ln\left(Z_T\right)} = \frac{\lambda_\theta^B + \frac{1}{\upsilon} - 1}{\lambda_A^B \cdot \alpha\gamma} \cdot \frac{\theta}{\theta+\underline{\theta}} \qquad (4.24)$$

Similarly, the marginal rate of substitution between public capital Z_H and public service θ:

$$\frac{\dot{Z}_H}{\dot{\theta}} = \frac{\partial \ln\left(U_g\right)/\partial \ln\left(\theta\right)}{\partial \ln\left(U_g\right)/\partial \ln\left(Z_H\right)} = \frac{\lambda_\theta^B + \frac{1}{\upsilon} - 1}{\lambda_H^B \cdot \mu\eta} \cdot \frac{\theta}{\theta+\underline{\theta}} \qquad (4.25)$$

See Appendix B for detailed calculation of Eq.(4.24) and (4.25).

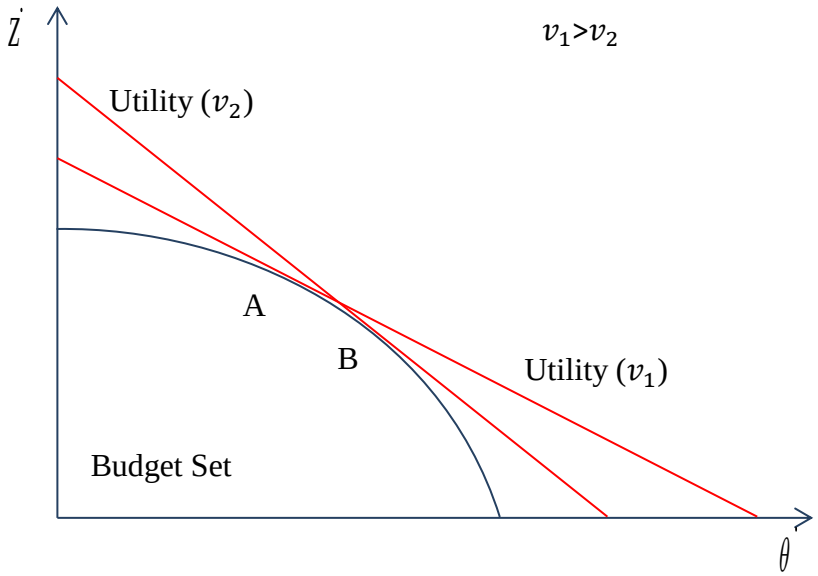

Figure 4.4 Local government's preference and public good choices

Note:
The ln linear utility curve Utility (υ_1) has a higher weight on GDP than the utility curve Utility (υ_2). The public expenditure choice with Utility (υ_1) is A and that with Utility (υ_2) is B. The choice of public capital investment with A is more than that with B.

Figure 4.4 shows the impact of local government's preferences on public good choices. With the weight of υ_1 on GDP, the local public good choice is A; with the weight of υ_2 on GDP, the local public good choice is B ($\upsilon_1 > \upsilon_2$). The public capital investment with A is more than that with B. It implies that when local assigns more weights on GDP, the public expenditure on public capital T or H will be higher than public service.

The intuition is straightforward. By increasing the weights on GDP, it will increase the marginal utility of GDP. Hence, the marginal utility with respect to the factor inputs of GDP will increase. As a result, public capital becomes more valuable which requires a greater amount of public service to exchange for public capital to achieve the same utility. In sum, as the weights of GDP increase, the marginal rate of substitution of public service for public capital is

decreased.

Claim #5: *If more weights local government puts on GDP, more will be spent on increasing public capitals (either* Z_T *or* Z_H *) than public service* θ.

4.4 Summary

The study examined the comparative static tax effect on local wage rate, housing rental price and city size. The finding has shown that VAT depressed all the city performances, while APT depressed the housing rental price and city size, but enhanced the local wage rate.

This finding is consistent with Polinsky and Rubinfeld(1978)'s finding that property tax increases local wage rate and the total-of-tax housing price, while decreases the net-of-tax housing price and land rent. While their city is similar to Muth's model, in contrast, we did not account for transportation cost and the shifting of the land boundary for different uses. In addition, we are able to determine the city population changes with the tax rate while they did not. The analytical strategy of our study in this section is similar to his in that we discuss the tax price elasticity of the city performance given public goods.

It is also consistent with the finding of Lin (1986) that property tax increases local wage rate and the total-of-tax of housing rental price. Our model shares several features resembling Lin(1986), although there are distinctions between ours. The similarity is that we conduct the property tax incidence in a general equilibrium with both mobile capital and labor. We are differing in that his model assumes finite number of cities, in which the private capital return is determined in the nation's market. As a result, the property tax induces the reduction of private capital return in his study. We assume many smaller open cities, such that the number of the cities is large enough that we can ignore the fiscal externalities on other cities. This assumption also warrants that the property tax imposition did not affect the private capital return, because the private capital return is exogenously determined in the world market. We feel

that our model is more realistic because the current capital market is open and the private capital is freely traded in the world market. Our model also differs from Lin's model in that our model incorporates public inputs in both traded and non-traded good production function, while his model did not.

It also found that both VAT and APT depress the non-traded to traded goods output and its ratio. In addition, both taxes depress the traded and non-traded sector land rents, but VAT does not affect the non-traded to traded sector land rent ratio, while APT depresses the ratio of non-traded to traded land rent ratio.

This study also investigates the opportunity cost of public service provision under the condition of equivalent initial tax revenue for the two tax regimes. It found that the differential incentive of the tax regime was mainly driven by its impacts on the city size. The higher the larger city size associated with the tax regime, the smaller the incentive to provide public service relative to public capital investment.

Finally, the incentive of supplying public service is also affected by local government's preference of economic development versus the quality of life. The analytical result shows that the more weights local government assigns to economic development, the greater the incentive for public capital investment than for public service provision.

Chapter 5 A Simulation Analysis of China's Urban and Local Public Finance Reform

5.1 China's Institution Background

Before 1978, China was a highly centralized and planned economy. Local revenues and public services were provided mainly by state-owned enterprises (SOEs) through profit remittances. The market reform in 1978 caused a decrease in SOEs profits, due to the gradual product price marketization and the competition from non-state enterprises. Hence, to accommodate the multi-ownerships of economic activities and increase the fiscal revenue, the "fiscal contracting system" reform in 1980s restored the tax-based revenue system [10] and decentralized the revenue sources to local governments. Value-added tax (VAT) was introduced for pilot-experiment in Shanghai in 1981, which was then spread out to the rest of the country from 1982 onwards. In 1985, the VAT (turnover tax) contributed to 46.72 percent of the total tax revenue; the ratio continued to increase to 52.84 percent in 1988[11]. The local government budgetary revenue relied mainly on VAT. This "fiscal contracting system" reform caused central government revenues to decrease, since the local government had a tendency to avoid sharing the fiscal revenue with central government by shifting the tax bases to extra budget. Hence, in order

[10] Many categories of taxes were implemented between 1949 and 1952, but later from 1953 to 1978 the taxes were abolished as a result of simplification of the tax system led by the "leftist" theory, which states that socialism needed not taxation (See Appendix C for detailed presentation of the China's fiscal system evolution).

[11] Data on turnover tax can only be obtained from 1985 in China Financial Yearbook. The calculation here is based on the broader definition of VAT encompassing the turnover tax on goods (product tax), turnover tax on services (business tax) used at that time in China, because VAT at this time is not strictly defined and later reforms replaced the turnover tax with VAT.

to recoup the central tax revenue, the "tax sharing system" was initiated in 1994.

The "tax sharing system" assigns shares of VAT revenue between central and local government at the ratio 3:1. Consequently, central government's fiscal revenue shares about 60 percent of total fiscal revenue. However, in order to gain support from the local governments for this "tax sharing system" reform, 20 percent of the total fiscal revenue was transferred back to the local government. The principle transfers come from the VAT rebates. The VAT rebate consists of two parts. The first one is a lump-sum transfer that aims to preserve the revenue at level of 1993. The second one is a growth rebate at 30 percent rebate rate based on the growth of VAT[12]. As the revenue grows quickly, the relative size of the lump-sum transfer is smaller and the growth rebate becomes dominant in tax rebate, which indicates that VAT tax becomes a pro-growth tax. Hence, despite local budgetary revenue share decreasing, the role of VAT in local budgetary revenue remains critical after accounting for the tax rebates.

The major property-type taxes included the Urban Real Estate Tax, Land Use Tax and Real Estate Tax, which were implemented in 1951, 1986 and 1988, respectively. The Urban Real Estate Tax was levied on foreign enterprises and individuals, but was abolished in 2009. The Land Use Tax was levied based on land areas at a rate ranging from 0.3-10 yuan/m^2. Real Estate Tax was levied mainly on domestic ownership of housing property, and exempted for residential housing. The smaller tax bases, in addition to the lower tax rate together account for the limited share of property-type tax in local tax revenue. The property-type tax revenue makes up less than 10 percent of local tax revenue. Residential property tax has been a major source of local tax revenue in many other countries; however, it has not been formally enacted in China.

[12] The criteria of the transfer of VAT rebate bases on two formulas: one is the 100 percent lump-sum transfer according to the revenue level in 1993, the aim is to maintain the at least no-worse-than the level its expenditure in that year; the other is the transfer of 30 percent of the growth of VAT applicable to the year after 1994(see Lin (2011) for a detailed illustration of the VAT rebate system).

The expenditure responsibilities were financed by the central governments during the planned economy and the local government plays its role as an agent of the central government to implement the designated expenditure plan. The "fiscal contracting system" in 1980s decentralized the public goods supply as well as the financing responsibilities to local governments. A local government's expenditure responsibilities include not only the local public service provisions but also the local economic developments. Urban maintenance and construction is an exclusive responsibility of local government. Although the public services such as education, health care, and social security are shared responsibilities by the central and local government, the local government is responsible for a majority share. For example, in 2003, the share of central to local expenditure in health care is 3:97, education is 8:92, and social security is 11:89 (Martinez-Vazquez and Qiao, 2011). These expenditure responsibilities of the local government were not reduced as which should have been in corresponding to the fiscal revenue recentralized in the "tax sharing system" reform in 1994.

The decreasing budgetary tax revenue, along with the increasing expenditures at the local level due to the rapid urbanization, has shifted local government's focus from public goods supply to public goods financing. Given the inadequate revenue resources from the formal fiscal system, local governments seek extra-budgetary channels to finance the growing expenditures. Land transfer fee[13] has become an important extra-budgetary revenue source as a result of the land value marketization since 1987. The increasing reliance on "land transfer fee" has caused dramatic farmland requisitions and in effect sparked political resistance from farmers.

The current policy debate is whether to implement residential property tax. Chinese scholars focus on several issues. First, whether implementing residential property tax can improve the current tax system. It argues that residential property tax can provide local government a valid tax instrument

[13] Land transfer fee is paid in an upfront lump sum to local governments for obtaining land use rights to develop commercial housing.

for the welfare distribution to reduce the gap between the rich and the poor. Second, whether the residential property tax reform can provide a stable fiscal revenue flow, in order to confront the problem of decreasing available land areas for sale. Third, many studies focus on the impacts of residential property tax on the housing market. Some studies argue that the residential property tax would increase housing price, while the others hold the opposite views. However, no consensus has been achieved on this issue. In addition, most studies were descriptive analyses and the theoretical studies were just started last year. Moreover, few studies examine the impact of the residential property tax reform on the transformation of Chinese economic growth pattern. Our model enables us to address these concerns[14] in an all-round way, which provides not only a quantitative analysis on how the property tax would affect the whole economy, but also the political economic implications on the degree of support for the residential property tax reform. We will address the following issues in this chapter:

(i) The impacts of residential property tax on the housing market

(ii) Can residential property tax help promote a sustainable growth pattern based on consumption growth?

(iii) The role of the primary objective of GDP in the government's public expenditure choice

(iv) The political implications for implementing residential property tax

This chapter proceeds as follows. Section 2 presents the model calibration. It firstly justifies the assumptions of the theoretical model that are applicable in China. Secondly, it parameterizes the production technology and household preference. Then, it obtains the residential property tax rate using the equal revenue approach. It furthers to calibrate the initial public goods with the VAT regime. Finally, it verifies the validity of the parameter value and the tax rate

[14] Except that the welfare distribution.

chosen under the current VAT-dominated tax system. Section 3 provides simulation results on the public goods choice under VAT vs. VAT-and-APT (VAT&APT) regime and with the alternative weights on the GDP objective. It also provides an attempt to investigate the impacts of location specific attributes on the political support of APT reform and the local GDP. Section 4 addresses the issues presented in the outset to provide policy implications in China's current system.

5.2 Model Calibration

We consider a local government's incumbency of a median-term (e.g. 5 years). Given the initial capital stocks and urban amenity levels, the incumbent local government makes the expenditure choice that will maximize his utility, consisting of GDP and the quality of life $U_g(GDP, \Theta)$, $(\Theta = \theta + \underline{\theta})$, and subject to the balanced budget constraint.

5.2.1 Justifications of the Assumptions

The theoretical model stated in Chapter 3 assumes that (i) there are many small open cities, (ii) both firms and developers are perfect competitors, and (iii) workers are freely mobile.

(1) "Many Small Open Cities"

China started the "open market" reform in 1978. Since then, China's economy has gradually transformed from planned economy to market-oriented economy.

In 1980s, the first special economic zones are granted to Shenzhen, Zhuhai, Shantou, Xiamen, and Hainan, which are provided privileges in economic policy for doing business, especially export-oriented business. In 1984, 14 more coastal cities are open to foreign investments. Since 1988, the mainland

China has opened a number of border cities and all the capital cities of both inland provinces and autonomous regions[15].

From 1978 to 2009, the number of Chinese cities has increased from 233 to 657, which increasingly enhances the intergovernmental competition for fiscal and political purpose (Li, 2011).

Therefore, due to the openness of China's economy and the vast number of cities in China, it is sufficient to make the assumption that they are "many small open cities".

(2) "Perfectly Competitive Firms and Developers"

Although it is still on its way toward market economy, the openness of Chinese cities to foreign investments has led to increasingly capital mobility. Foreign capital investments in China have increased from average US$2.3 billion in 1984-1989 to US$40.6 in 1995-1999 and US$191.26 billion in 2008-2012. In 2005, the total number of private enterprises is 1.98 million, which increases 49 percent relative to 2001, whereas, the state-owned and collectively owned enterprises decrease 48 and 46 percent compared with 2001, respectively[16]. Therefore, the traded goods firms are competitive.

The share of housing constructions by private developers has had an increasing rate in the total housing supply, since the housing marketization reform in 1998[17]. Therefore, the housing developers are competitive in China's housing market (Fu et al, 2010).

[15] See "Special Economic Zones of the People's Republic of China" from Wikipedia, the free encyclopedia.
[16] Bulletin of National Economic Census 2005.
[17] The new urban homes traded in the housing market shared over 60 percent. The private residential developers were arising to over 60 thousand in 2008. The largest housing developers have a small market share of about 4.2 percent in 2004. See Fu et al (2010).

(3) "Freely Mobile Workers"

Labor mobility is constrained by the Household Registration System, which is a unique feature of China's governance system. In 1958, the first restrictive regulation on rural-urban migration was issued with the purpose of limiting overflow of rural labor into urban locations. In 1978, the restriction was relaxed to allow high skilled workers and their families to obtain a citizenship. Along with the increasing "open market" reform, the household registration system was gradually reformed and an increase in rural-urban migration occurred.

The urbanization rate increased from 13 percent in 1958 to 18 percent in 1978. From 1978 onwards, the urbanization process experienced rapid growth rates to 33 percent in 1998 and then 50 percent by 2009. This rapid urbanization was driven by the economic growth accompanying with the housing and labor market reform (Fu et al.2008). The massive labor relocation is documented in the 2000 population census that labor mobility to the city accounts for 77.9 percent of the total mobility in China and 40.7 percent was attributed to inter-city labor mobility. Rural-city mobility makes up for the remaining percentage. It should be noted that inter-city labor mobility is experiencing a more rapid increase than the rule-urban mobility. The current policy reform also endeavors to further relax the labor mobility. Therefore, the free labor mobility assumption can be warranted from this point of view.

Overall, considering the context of China stated above, we cannot reject that the theoretical model can be applied to China to understand the issues of residential property tax reform.

5.2.2 Parameterizing the Model

(1) Production Technology and Household Preference

For this numerical analysis, data was sourced from China Financial Yearbook

1978-2010 and Statistical Yearbook of The Chinese Investment in Fixed Assets.

This analysis calibrates the parameters into China's case that the wage share in GDP is around 50 percent, hence the capital share in traded and non-traded goods sector is chosen at $\alpha = 0.5$ and $\mu = 0.5$, respectively; accordingly, the wage share in both sectors are $1-\alpha = 0.5$ and $1-\mu = 0.5$, respectively. Since housing supply elasticity ($1/\mu\eta - 1$) is close to 1.5 in China (Fu et al, 2010), the public capital share in total capital employed is $\eta = 0.8$. Since the public capital investment accounted for an average of 70 percent of total capital investment from 1980 to 2000 (Statistical Yearbook of The Chinese Investment in Fixed Assets), the public capital share in total capital employed is $\gamma = 0.7$. The housing expenditure in China is about 50 percent of total income $\beta = 0.5$. The agglomeration economies are selected at $\omega = 0.03$.

Table 5.1 Parameter values

Variable	Selected Value	Empirical Value
α	0.5	Wage share of GDP is around 50 percent
γ	0.7	Public capital share in total capital investments at around 70 percent.
μ	0.5	Wage share of GDP is around 50 percent
η	0.8	Housing supply elasticity ($\frac{1}{\mu\eta} - 1$) at 0.62-1.46
β	0.5	Housing expenditure shares around 50 percent of total income in China
ω	0.03	0.01-0.4

Wage share of GDP is from Vincelette et al(2010); housing supply elasticity at 0.62-1.46 is from Fu et al(2010); other parameter values are empirical value.

(2) Initial Tax Rates under Equivalent Tax Revenue

The tax rate of VAT in China ranges from 3 percent to 17 percent, with the

majority of goods and services subject to 13 percent to 17 percent tax rates. This study chooses the 13 percent VAT rate as the initial tax rate for the analysis $\tau_{v0} = 0.13$. Then, we consider tax regime change by reducing VAT from 0.13 to 0.10 and initiating APT to compensate the loss of the VAT revenue.

Since the traded and non-traded goods output ratio is independent of the public goods, APT rate can be calibrated with the specified production technology and household preference under the condition of equivalent initial tax revenue, regardless of initial public goods. Using a simple search algorithms method, the APT tax rate is solved at $\tau_P = 0.1171$. We denote the new tax regime as VAT&APT.

Therefore, our focus is on the impacts of the tax regime change from the old tax regime VAT $\tau_{v0} = 0.13, \tau_{P0} = 0$ to the new tax regime VAT&APT $\tau_v = 0.10, \tau_P = 0.1171$. These impacts include the public expenditure choice, the city housing rental price, wage rate, city size and non-traded incremental land rent and GDP.

(3) Initial Public Goods Calibration

Despite the existence of an item called "capital construction" in the budget account in the China Financial Yearbook, many capital constructions done by different departments are not included in the "capital construction". Therefore, the public capital stock is not well documented in China's database. We use our model with the identified production technology, household preference and taxes to solve for initial public goods. The initial public goods are calibrated under the VAT regime, as the present China's tax system is without APT.

The public capital stock calibration is based on its contribution to GDP. According to Eq.(4.24), GDP is calculated with

$GDP = (1+\tau_{P0})PQ_H + Q_T = \left[\phi(\tau_{v0},\tau_{P0})+1\right]\cdot Q_T$. Public capital T in the traded sector is $Z_T = \alpha\gamma \cdot Q_T$, inserting into the above GDP formula to obtain the contribution of the public capital T stock to GDP $GDP = \left[\phi(\tau_{v0},\tau_{P0})+1\right]\cdot Q_T = \left[\phi(\tau_{v0},\tau_{P0})+1\right]\cdot \frac{Z_T}{\alpha\gamma}$. Therefore, the public capital T stock is solved for by inversing the public capital T contribution function as follows,

$$Z_{T0} = \alpha\gamma \cdot Q_{T0} = \alpha\gamma \cdot \left[\frac{GDP_0}{\phi(\tau_{v0},0)+1}\right] \qquad (5.1)$$

The average GDP is 722.33 (10billion yuan), which is obtained from the China Financial Yearbook that covers the period 1978-2008[18]. Since the public capital stock comprises about 27 percent of GDP, from Eq.(5.1) the public capital T stock is 195.9810 (10billion yuan) $Z_{T0} = 195.9810$.

The public service includes the cultural, education and health. The expenditure on public service shared local GNP 2.76 percent in 1978, 2.85 percent in 1988, 2.3 percent in 1995, 2.48 percent in 1998, and 2.67 percent in 1999 (Wong, 2002)[19]. The public service, natural amenities and initial public capital H are solved based on three conditions (i) the GDP equals 722.33; (ii) the public service expenditure is averaged 2.61 percent of GDP; (iii) the fiscal revenue is around 10 percent of GDP[20]. Therefore, the initial public goods are solved for at $Z_{H0} = 217.2358$, $\theta_0 = 1.132$ and $\underline{\theta} = 8.0664$.

[18] Since the China Financial Yearbook does not contain the city level data, we use the aggregate GDP instead. Moreover, this study is limited with the GDP value without excluding agricultural, fishery and forest industry.

[19] We acknowledge the inaccuracy of using GNP instead of GDP, but the share won't be affected too much, because the GNP to GDP ratio ranges between 98.3 percent and 100.44 percent from 1990 to 2010.

[20] Calculated from China Financial Yearbook 1978-2010.

(4) Examining Validity

We compare the calibrated results with the statistical data or the existing studies on the explained variables to examine the validity of the parameter choice and tax rates of VAT specified above. This examination will not include residential property tax because it is unavailable in the statistical data under the present system of China. Table 5.2 presents the result.

Table 5.2 Testing parameter and tax rate of VAT choice

Variable	Calibrated Value	Statistical Value
Q_{T0}/GDP_0	0.7752	Around 70%
RV_0/GDP_0	0.1008	10%-31%

The statistical value of traded goods share in GDP is obtained from WB(2010) by removing agriculture sector; the tax revenue to GDP is the average value from China Financial Yearbook 1978-2008.

The result shows that the traded goods output takes up around 77.5 percent of GDP. It also shows that the tax revenue share of GDP is at 10.1 percent. In comparison, statistical data shows that traded goods contribute to GDP at around 70 percent in recent years and the tax revenue to GDP ranges between 10 percent and 31 percent. Our calibration results fall within the feasible range, which verified the chosen value of the parameter and VAT rate at 0.13.

5.3 Simulation Results

This simulation focuses on the government's public goods choice between public capital T and the public service, given public capital H. Similar analysis can be applied to the public goods choice between public capital H and public service, which is not included in this study.

5.3.1 The Simulation Results of Public Goods Choice

(1) The Diagrammatical Simulation Results

After setting the initial public goods and the tax rates, we can simulate diagrammatically, corresponding to Chapter 4, the PPF of the budget constraint for the VAT and VAT&APT, and the effects of different preference for GDP, as shown in Figure 5.1.

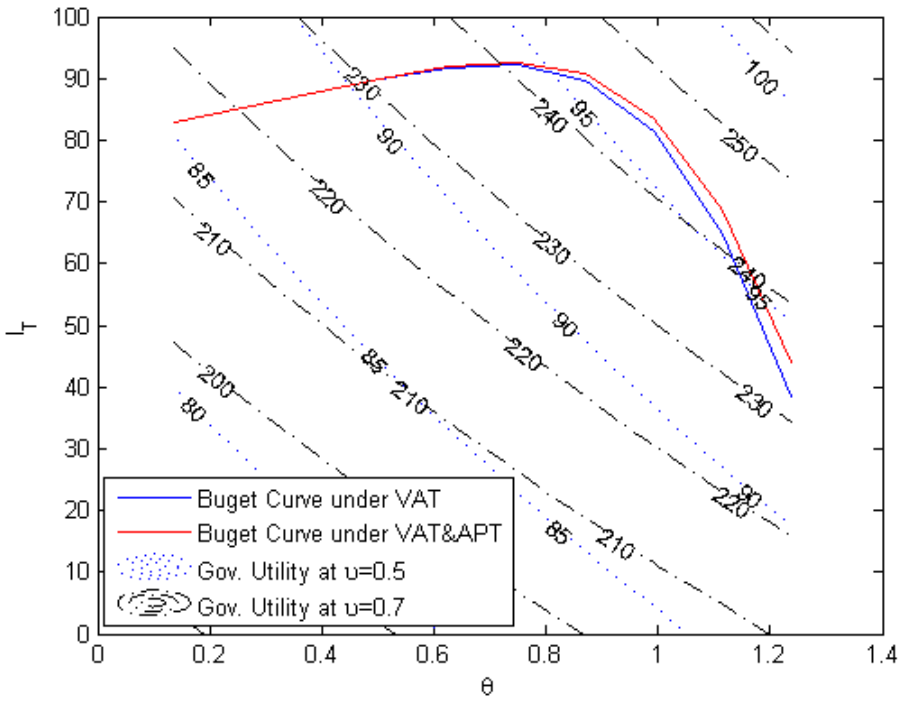

Figure 5.1 Local government's public goods choice incentives

Note:
The "Budget Curve under VAT" shows the production possibility frontier (PPF) for public capital T (I_T) and public service (θ) provision under the VAT regime, while the "Budget Curve under VAT&APT" shows the PPF under VAT&APT regime. The PPF of budget constraint is steeper with VAT than VAT&APT. The government utility curve is plotted with the weights of 0.5 and 0.7 on GDP, separately. The higher the weight is, the steeper the slope.

Figure 5.1 exposes the public goods choices between public capital T and public service. They show that under the VAT regime, the PPF is steeper than VAT&APT, which implies that the incentive to provide public service is lower under VAT than VAT&APT. It also shows that the higher weight on GDP is, the lower the incentive to provide public services.

In addition, we can solve for the initial housing rental price, local wage rate, and city size, the traded and non-traded goods outputs and their ratio. Table 5.3 presents these initial city statuses.

Table 5.3 The initial city profiles of China

Variable	**VAT** $\tau_V = 0.13, \tau_P = 0$	**VAT&APT** $\tau_V = 0.10, \tau_P = 0.1171$
N_0	$1.8274 \cdot 10^3$	$1.7438 \cdot 10^3$
P_0	0.6681	0.6522
W_0	0.1777	0.1856
$P_0 Q_{H0}$	162.3843	144.8524
Q_{T0}	559.9457	558.2531
$\phi(\tau_V, \tau_P)$	0.29	0.2595

$\alpha = 0.5$， $\gamma = 0.7$， $\mu = 0.5$， $\eta = 0.8$， $\omega = 0.03$， $\beta = 0.5, \upsilon = 0.7, b = 6$， $\varepsilon = 0.0012$

The second column of Table 5.3 presents the initial city profiles of the VAT regime, while the third column illustrates the case of the new tax regime of VAT&APT.

As shown in Table 5.3, the initial city size and housing rental price under VAT are bigger than under VAT&APT, while the local wage rate is relatively lower under VAT regime than that under VAT&APT regime. According to Claim #4, it indicates that the opportunity cost of supplying public service is higher under VAT than VAT&APT due to the larger city size associated with the VAT regime. This also accounts for the simulation result of the PPF with VAT

is steeper than with VAT&APT in Figure 5.1.

In addition, as shown in Table 5.3, given the public goods, shifting from VAT regime to VAT&APT regime, both non-traded and traded goods outputs decrease; this finding is consistent with Claim #2. Moreover, the reduction of the non-traded goods output is much larger than that of traded goods output, which indicates that by changing the tax regime from VAT to VAT&APT regime under equivalent initial revenue, there is a substantially greater impact on the non-traded goods than traded goods, as the non-traded sector is less mobile and in effect would bare more burdens of the taxation, which is indicated by the ratio of non-traded to traded output ratio $\phi(\tau_V,\tau_P)$ decreasing from 0.29 under VAT to 0.2595 under VAT&APT.

(2) Residential Property Tax vs. Value-Added Tax

As suggested by Eq.(4.21), the different tax regimes affect the public goods choice through substitution effects as well as via the income effects. Therefore, the resulting public goods levels reflect not only the substitution effects, but also the income effects. The income effects may confound the substitution effects when we compare the level of the public goods with changing the tax regimes. As local government incentive for public goods choice between public capitals versus public service is mainly determined by the substitution effect, we use the expenditure share in the tax revenue to measure this substitution effect and disentangle the income effect.

Row 2 of Table 5.4 shows the public goods choice under the two alternative tax regimes. The share of the expenditure of the two public goods is presented in the third and fourth rows to indicate government's expenditure incentive. From the fifth to seventh rows, the results are stated on the impacts of government's expenditures on the housing rental price, wage rate and city size, respectively.

Table 5.4 Numerical results of public goods choice under different tax regimes

Variable	**VAT**	**VAT&APT**
(I_T, θ)	(80.5172, 0.9844)	(80.6346, 1.0047)
I_T/RV	0.8733	0.8713
$C(\theta,N)/RV$	0.1267	0.1287
P	0.766	0.7482
W	0.1934	0.2016
N	2126.9	2041.2

$\alpha = 0.5$， $\gamma = 0.7$， $\mu = 0.5$， $\eta = 0.8$， $\omega = 0.03$， $\beta = 0.5, b = 6$， $\varepsilon = 0.0012$

It shows that under the old tax regime with single VAT, the expenditure on both public goods is less than that under the new tax regime of VAT&APT, which indicates that implementing APT expands the fiscal revenue. It also shows that the public service expenditure share increases by shifting to the new tax regime. Moreover, the implementation of APT will result in a higher local wage rate, but a lower housing rental price and a smaller city size. These findings imply that imposing residential property tax can mitigate the house price and increase the government's incentive to provide public services. It contributes to the current debates on whether the residential property tax can help curb the high housing price and reduce local government's incentive for public capital investment in China.

(3) Objective of GDP vs. Quality of Life

Local government's preference for GDP and the quality of life is indicated by the weight υ. This simulation chooses two alternative weights $\upsilon = 0.5$ and $\upsilon = 0.7$ to investigate the effects of government's more preferences for GDP in China.

Table 5.5 presents the result of the impacts of the different weights assigned to GDP and urban quality of life on the local public goods choice. The second

column states the result of equally weighted GDP and urban quality of life, while the third column depicts more weights assigned to GDP than the quality of life.

Table 5.5 Numerical result of public goods choice with different preference

Tax regime	$\upsilon = 0.5$ (I_T, θ)	$\upsilon = 0.7$ (I_T, θ)
VAT	(76.9711 , 1.0241)	(80.5172, 0.9844)
VAT&APT	(77.0339 , 1.0451)	(80.6346, 1.0047)

The impacts of different preference on the public goods choice need not use the public expenditure's share to indicate the spending incentive, because they go to the opposite direction. Other parameters values are $\alpha = 0.5$, $\gamma = 0.7$, $\mu = 0.5$, $\eta = 0.8$, $\omega = 0.03$, $\beta = 0.5, b = 6$, $\varepsilon = 0.0012$.

Under the equal weights between GDP and quality of life, the government's choices of the public capital T and the public service are 76.9711 and 1.0241 under the VAT regime, and 77.0339 and 1.0451 under the VAT&APT regime, respectively. In the case of more weights on GDP than the quality of life, the public capital T and public service choice are 80.5172 and 0.9844 under the VAT regime, and 80.6346 and 1.0047 under the VAT&APT regime, respectively. These results show that the more weights local government assigns to GDP, there will be a greater expenditure on public capitals and less on public service, which imply that the more weights on GDP is, the more incentive to public capital investments

Hence, given that local governments in China have been documented with giving first priority to local economic development (e.g. Zhuravskaya, 2000), this finding attributes the inter-governmental competition for public capital investments to the incentive of GDP objective.

5.3.2 The Public Goods Choice for Different Types of Cities

The different types of cities are measured in terms of the production

technology (α, γ, μ and η) and household preference (β). The following numerical results are based on the change of the parameters at uniformly increasing 0.1 relative to the based case $\alpha = 0.5$, $\gamma = 0.7$, $\mu = 0.5$, $\eta = 0.8$, $\beta = 0.5$. Changing the production technology and household preference will cause the residential property tax rate to vary according to the equivalent initial tax revenue, as shown in Table 5.6.

Table 5.6 Numerical results of residential property tax rate in different cities

Parameters	$\alpha = 0.5, \gamma = 0.7, \beta = 0.5$ $\eta = 0.8, \mu = 0.5$	$\alpha = 0.6$	$\mu = 0.6$	$\eta = 0.9$	$\gamma = 0.8$	$\beta = 0.6$
APT(τ_P)	0.1171	0.1571	0.1213	0.1142	0.1193	0.1641

APTs are calibrated using the same approach aforementioned in Section 5.2.2: shifting the tax regime from VAT $\tau_{v0} = 0.13$ to VAT&APT by reducing VAT to $\tau_v = 0.10$ and initiating with APT; then, this APT is solved with the equivalent initial tax revenue condition. Other parameters are fixed: the publicness $\varepsilon = 0.0012$; the agglomeration economies $\omega = 0.03$; the weight on GDP is $\upsilon = 0.7$.

Based on the above APTs, the public goods choice in different cities is then calculated in Table 5.7.

Table 5.7 Numerical results of public goods choice in different cities

Parameters	**VAT** **(I_T, θ)**	**VAT&APT** **(I_T, θ)**
$\alpha = 0.5, \gamma = 0.7, \beta = 0.5$ $\eta = 0.8, \mu = 0.5$	(80.5172, 0.9844)	(80.6346, 1.0047)
$\alpha = 0.6$	(42.5496, 1.1239)	(42.5297, 1.145)
$\mu = 0.6$	(68.1932, 1.0868)	(68.2202, 1.0982)
$\eta = 0.9$	(87.6131, 0.9394)	(87.72, 0.9567)
$\gamma = 0.8$	(85.3737, 0.9543)	(85.5053, 0.9762)
$\beta = 0.6$	(88.5117, 0.956)	(88.7028, 0.9778)

$\omega = 0.03$, $\varepsilon = 0.0012$, $\beta = 0.5$, $\upsilon = 0.7$

The second column in Table 5.7 shows the public goods choice under the VAT

regime for different types of cities. The results for the VAT&APT regime are presented in the third column. For a city with a higher capital intensity production technology $\alpha = 0.6$, its public capital expenditure is higher under VAT&APT regime than under VAT regime, while contrarily the public service is lower, which indicates that the incentive for public service expenditure is higher by initiating APT. The reasoning is that the lower labor factor share (higher capital intensity) in the production induces a smaller city size, which has a lower cost for public service provision; therefore, the opportunity cost for supplying public service will be lower.

For other types of cities, both the public capital and public services levels are higher with the VAT&APT regime than with the VAT regime. It indicates that the fiscal capacity is expanded for these cities[21]. Therefore, to identify the incentive of government for expenditure choice in the different cities, the share of public goods expenditure is used, as shown in Table 5.8.

Table 5.8 Numerical results of public goods expenditure share in different cities

Parameters	**VAT** $(I_T/RV, C(\theta,N)/RV)$	**VAT&APT** $(I_T/RV, C(\theta,N)/RV)$
$\alpha = 0.5, \gamma = 0.7, \beta = 0.5$ $\eta = 0.8, \mu = 0.5$	(0.8733, 0.1267)	(0.8713, 0.1287)
$\alpha = 0.6$	(0.8344, 0.1656)	(0.8319, 0.1681)
$\mu = 0.6$	(0.852, 0.148)	(0.8508, 0.1492)
$\eta = 0.9$	(0.8838, 0.1162)	(0.8821, 0.1179)
$\gamma = 0.8$	(0.8926, 0.1074)	(0.8906, 0.1094)
$\beta = 0.6$	(0.8902, 0.1098)	(0.8883, 0.1117)

$\omega = 0.03$, $\varepsilon = 0.0012$, $\beta = 0.5$, $\upsilon = 0.7$

Table 5.8 shows that in every type of city, shifting from VAT regime to

[21] We also found that the fiscal revenue with the higher capital intensity city ($\alpha = 0.6$) is 50.9934 with VAT and 51.1225 with VAT&APT, which also demonstrates the expansion of the fiscal revenue with initiating APT, as is consistent with the other types of cities.

VAT&APT regime increases the expenditure share of public service, which implies that APT enhances local government's incentive for public service provision regardless of the types.

In the base case, the public capital expenditure share is 87.33 percent and the public service is 12.67 percent of total budget outlay under the VAT regime. For a higher capital intensity in the traded sector $\alpha = 0.6$, the public capital expenditure share is 83.44 percent and the public service expenditure is 16.56 percent. In the non-traded sector, a higher capital intensity $\mu = 0.6$ results in 85.20 percent of public expenditure on public capital and 14.80 percent on the public service. It implies that the expenditure on public service increases with a higher capital intensity, while the public capital investment decreases for both tax regimes. The reason is that the higher capital intensity induces a smaller city size, which mitigates the opportunity cost of public service provision. Therefore, the local government in a city with a higher capital intensive production will have more incentive to increase public service expenditure.

By contrast, the higher public capital share in both traded and non-traded goods production $\gamma = 0.8$ and $\eta = 0.9$ will induce the local government to spend less on public service provision, because these two factors increase the productivity of the pubic capital, which is taken as given for production when they choose private inputs. Consequently, the production output is larger, which can accommodate relatively more people. Therefore, a larger city size will induce lower incentive for public service provision.

Similarly, the higher preference for traded goods ($\beta = 0.6$) induces a larger city size as each individual consumption less non-traded goods, hence more people can be accommodate. A larger city size leads to a lower expenditure in public service.

5.3.3 Non-traded Incremental Land Rents in Different Types of Cities

We use the non-traded incremental land rent to measure the response of different types of cities to the APT reform, because the vested interest that influences the reform receives the non-traded incremental land rents. The non-traded incremental land rent refers to the incremental land rent in the non-traded sector resulting from local government's public capital investment and public service provision.

Table 5.9 Numerical results of local non-traded incremental land rents in different cities

Parameters	**VAT**	**VAT&APT**	**% change**
$\alpha = 0.5, \gamma = 0.7, \beta = 0.5$ $\eta = 0.8, \mu = 0.5$	17.3185	15.7242	-9.2058
$\alpha = 0.6$	5.4602	4.7061	-13.8108
$\mu = 0.6$	15.307	13.9206	-9.0573
$\eta = 0.9$	21.1395	19.2963	-8.71922
$\gamma = 0.8$	19.2712	17.3661	-9.8857
$\beta = 0.6$	16.0562	13.9614	-13.0467

The non-traded incremental land rent measures the land rent increase in the non-traded sector as a result of governments public goods choice in comparison to the initial land rent $\Delta LR_H = LR_H - LR_{H0}$. Other parameters values are $\omega = 0.03$, $\varepsilon = 0.0012$, $\beta = 0.5$, $\upsilon = 0.7$.

Table 5.9 shows the results of the non-traded incremental land rent for different types of cities after government's expenditure choice. The second and third columns represent the two alternative tax regimes, respectively. The last column describes percentage changes of the incremental land rent by shifting from VAT to VAT&APT regime, which measures the magnitude of the city's response to APT reform.

It shows that by implementing APT, the non-traded incremental land rent is reduced relative to that under the VAT regime. In the base case, the reduction of non-traded incremental land rent is 9.2058 percent. The reduction is highest at -13.8108 percent in a city with a higher capital intensity in traded goods production (α); a higher preference for traded goods consumption (β) comes as the second largest impact at -13.0467 percent; the public capital share in traded goods production (γ) also strengthens the reduction of the non-traded incremental land rent.

The reasoning is that the higher share of capital factor in the traded goods production is associated with fewer labor inputs; hence, it results in a smaller city size, which lowers the demand of non-traded goods, consequently, the non-traded incremental land rent decreases. The non-traded incremental land rent is sensitive to capital intensity, because its negative effect on the city size acts directly through labor factor demand. A direct impact of the higher preference for traded goods consumption is the reduction of the non-traded goods consumption; hence it acerbates the reduction of the non-traded incremental land rent. The mechanism of the public capital share in the traded good production is distinct from the capital intensity and preference for traded goods aforementioned. The increase in traded sector's public capital input share will benefit the labor productivity, which increases local wage rate, city size, housing rental price, and consequently the non-traded goods consumption. However, this incremental land rent is more with VAT regime than with the VAT&APT regime. Therefore, the shifting of the tax regime from VAT to VAT&APT enlarges the gap with a higher traded goods' public capital share.

Both the total capital and public capital share in non-traded goods production (μ and η) mitigate the reduction of non-traded incremental land rent from the tax regime change, because those factors increase the non-traded land rent's share in the non-traded goods output, which can cushion the negative impacts from the tax regime change.

These results imply that the APT reform will encounter political resistance

owing to a reduction of the non-traded incremental land rent. In addition, cities with more capital intensity for traded goods production, higher preference for traded goods consumption, and higher public capital share in traded goods production would less likely support the APT reform. Cities with higher capital intensive and public capital share in the non-traded goods production will less likely resist the APT reform.

5.3.4 GDP in Different Types of Cities

The effect of the tax regime reform on the local GDP in different types of cities is shown in Table 5.10.

Table 5.10 Numerical results of GDP in different cities

Parameters	**VAT**	**VAT&APT**	**% change**
$\alpha = 0.5, \gamma = 0.7, \beta = 0.5$ $\eta = 0.8, \mu = 0.5$	914.9233	915.4889	0.0618
$\alpha = 0.6$	483.2603	479.1904	-0.1189
$\mu = 0.6$	783.0501	787.9543	0.6263
$\eta = 0.9$	983.7428	988.8981	0.5240
$\gamma = 0.8$	949.1523	946.0819	-0.0032
$\beta = 0.6$	931.1528	930.5226	-0.0677

GDP is calculated according to Eq.(3.23). Other parameters values are $\omega = 0.03$, $\varepsilon = 0.0012$, $\beta = 0.5$, $\upsilon = 0.7$.

Table 5.10 presents the results of the tax reform impacts on GDP for different types of city. The second and third column represents the VAT and VAT&APT regime separately. The last column shows the percentage change of GDP by changing the tax regime from VAT to VAT&APT regime. It shows that shifting the tax regime to VAT&APT can either increase or decrease the GDP, depending on the type of the city. For higher capital intensity and public capital factor share in the traded goods sector ($\alpha = 0.6$ and $\gamma = 0.8$) and the higher household preference for traded goods ($\beta = 0.6$), GDP with VAT&APT

regime will be lower than that with VAT regime. Increasing non-traded sector's total capital share ($\mu = 0.6$) and the public capital share ($\eta = 0.9$) will promote GDP by the implementation of APT.

5.4 Policy Implications

(1) The Impacts of Residential Property Tax on Housing Market

China's housing market has attracted huge investments. The continued high housing price could be attributed to the rapid urbanization and the lack of alternative investment goods in the financial market that are safer than housing. The urbanization rate is 53.73 percent in 2013. Chinese government aims to reach 75 percent to catch up with the developed countries in 2040. It implies that the housing price would be continuously high.

Our findings show that the residential property tax in comparison to the value-added tax results in a lower housing rental price, because the residential property tax is a consumer tax that increases the total-of-tax housing price, which disincentives the housing consumption. Therefore, residential property tax can curb both the individual's over consumption of housing and the investment-purposed housing consumption.

Therefore, residential property tax can rationalize the housing market.

(2) Can Residential Property Tax Help Promote a Sustainable Growth Pattern Based on Consumption Growth?

Local government's active role in public investment has become the driving force for the capital intensive growth pattern of China's economy over past decades. Figure C.3.3.1 shows that local expenditure on economic

development and urban utility consists of 35 percent of local total expenditure, relative to 25 percent on public service.

Our findings show that the current VAT-dominated tax system contributes to the public goods choice in preferring public capitals to public service, due to the higher opportunity cost of public service provision associated with the VAT regime. By implementing residential property tax, local government's public expenditure choice will turn over to increasing public service provision; it also increases local fiscal revenue, which expands the fiscal capacity, hence it can reduce reliance on "land financing".

In addition, local wage rate will increase with residential property tax in comparison to the value-added tax regime. This implies that the consumption share in GDP can also be increased.

Therefore, residential property tax can help promote a sustainable growth pattern by shifting a capital intensive growth mode to a consumption-based growth mode.

(3) What Is the Role of The Primary Objective of GDP in The Government's Public Expenditure Choice?

China's administrative system is a vertical 5-layer system, the center-province-city-county-townships, with each lower layer encompassing within the higher layer geographically and politically.

The Communist Party of China is the only ruling party in China, which determines the policy making decisions. The economic development policy has been setup as a nationwide overriding goal ever since the Communist Party assumed power in China. Policy implementation is monitored by the Communist Party at each level of government.

The local government officials are not elected by residents, but instead they are promoted by upper level officials based on the GDP growth. The upper

level officials belong to the Communist Party. Thus, the CP has the final say in an officials' promotion. The five-layer administrative system creates a vertical layer-by-layer responsibility system. The one party ruling system further solidifies the vertical relationship. Moreover, the personnel system strengthens the upward accountability. The government relationship at the horizontal level is relatively weak, which creates inter-governmental competition for GDP.

We find that local government pursuing GDP rather than the quality of life induces distortions on public expenditures that more is spent on public capital investments than public service provisions. Therefore, this primary objective of GDP also accounts for the capital-intensive growth pattern of China.

In sum, the GDP-oriented promotion system creates a barrier for APT reform because local governments lack the accountability to its residents. Therefore, increasing local government's accountability to local residents is critical for APT reform. There are two feasible proposals to increase the local government's accountability. One is to adjust the local government's career measurements by reducing the weights put on GDP; the other is increasing the transparency of the local budgeting process by publicizing the allocation of land transfer revenues and increasing public participations in the determination of local policies. To increase the accountability of local government to its residents, further reform on Household Registration System to emancipate the power of the "voting with feet" mechanism will increase local government's competition for people, which helps to constraint local government's behavior.

(4) The Political Implications for Residential Property Tax Reform

Urban land is owned by the state, but it is operated by the municipal governments. Since the urban land use has been reformed to market-oriented in 1987, land sales create a huge premium, which is the incremental land rent from non-traded sector.

Rural land is owned by the collectives for farmland use or for farmer's residential use. The residential land use, as stipulated, cannot be transacted in the open market. The privilege of local government to expropriate collective lands has provided them the monopoly power in the primary land market, which incentivizes them to rely on "land financing". Moreover, the lower compensation also creates a huge premium from converting the farmland to the industrial or commercial land. This further incentivizes local government's reliance on "land financing".

Our results show that the non-traded incremental land rent will decrease as a result of implementing residential property tax. This implies that local government who relies on "land financing" will resist the residential property tax reform.

Therefore, the residential property tax reform needs to be accompanied with the land management system reform, because allowing the rural residential land to be transacted in the open market can weaken the monopoly power of local government in the land market; in addition, increasing compensation for farmland acquisition can also rationalize government's incentive for "land financing".

5.5 Summary

This study has numerically examined the impacts of shifting the currently VAT-dominated tax system to incorporating APT in China. The findings have shown that by decreasing VAT level from 13 percent to 10 percent, there needs to be an increase of 11.17 percent in APT to compensate the loss of VAT revenue in the benchmark case. This shifting of the tax system will decrease the housing rental price, reduce city size and increase local wage rate. It has also found that while the incentive of the public service provision will be improved by initiating APT, the incremental non-traded land rent will be depressed. Therefore, implementing residential property tax is able to promote a sustainable economic growth pattern. However, it also implies that the local

governments will resist APT reform. We have also found that the local government putting more weights on GDP than on the quality of life accounts for the capital-intensive growth pattern of China's economy.

The examination of the responses to APT reform for different types of city has shown that they all resist APT reform but their degree of resistance varies according to the type of city. It has also found that GDP can be increased or decreased with the APT reform depending on the types of city. These findings imply that residential property tax reform needs take into account the different types of city.

The policy implication analysis has suggested that imposing residential property tax requires other complementary reforms, including the land management system, the local government's performance measurement and the Household Registration System.

In addition, the implementation of the APT reform also requires addressing technique issues, for example, housing market value assessment, property tax rate design for different cities, property ownership identification, and so on. However, these technique issues, as agreed by Chinese scholars, can be resolved.

In sum, addressing how the incremental land rent is allocated as well as local government's accountability to its local residents are critical for the APT reform to succeed.

Chapter 6 Conclusions and Extensions

Fiscal decentralization increases inter-governmental competition for mobile resources. The influence of competition for mobile resources on policy-making is a major subject of the tax competition literature (Matsumoto, 2004). This study examined the effect of value-added tax and residential property tax regimes on the incentive of local public goods choice.

6.1 Summary of Findings

Our findings have highlighted that the local tax structure in China dominated with VAT and without APT contributes to the public good choice of favoring public capital investments to public service provision. It has also demonstrated that the currently high housing rental price and low wage rate are attributed to this VAT-dominated local tax system. The critical endogenous variable that accounts for the local government's expenditure bias is the relatively larger city size with the VAT regime than that with the APT regime. This is because VAT, which acts as an external shock, depresses the city size less than that APT does as an internal shock. VAT affects the city performance in a way similar as productivity shock, while APT directly impacts labor supply by increasing the living cost of labors in terms of a higher total-of-tax housing price. Therefore, VAT causes fewer labors to flee away from the city than APT. The finding of the decrease in the incremental non-traded land rents has also implied the potential political resistance for APT regime from the city governments.

It has also examined different types of city by varying the capital intensity in both traded and non-traded goods production, public capital share in total capital in both traded and non-traded goods production, and household consumption preference. The responses of different types of city to the

residential property tax reform vary in degree, but they all resist to the reform in terms of reducing the non-traded incremental land rent. It has also shown that city GDP can either increase or decrease in different cities.

In addition, the investigation of the local government's preference for GDP has shown that the local government's GDP prior objective contributes to the capital investment rather than public service provision.

These findings has suggested that China's economic growth pattern of capital intensity is driven at least to some extent by the local tax structure without residential property tax as well as the GDP objective.

The study has also provided some political implications for APT reform. Since the APT reform will reduce the non-traded incremental land rent, the local governments who rely on "land financing" will resist to APT reform. For APT reform to succeed, improvement of the land management system and the local government's accountability to local residents are needed.

6.2 Contributions

The findings of this study have shown that city performance depends on local fiscal conditions of both taxes and public goods. However, the equilibrium tax bases of VAT and APT are independent of the public good mix. Existing studies argue that a public good has different impacts on the tax bases, which will induce different incentives for public goods choices (e.g. Brennan and Buchanan, 1978; Glaeser, 1996; Keen and Marchand, 1997). Our finding is in sharp contrast to this literature. This departure may lie in the model setup for two potential reasons: first, while their models are either the partial equilibrium model (e.g. city size fixed, income fixed) or do not account for the housing sector, our model is a general equilibrium model including the housing sector. The partial equilibrium model failed in capturing the local price variation. The housing sector is important at the local level because the property tax on housing is an important source of local fiscal revenue for

many countries. Given the advantages of a general equilibrium model in accounting for local price variance, it is possible that our findings would have more explanatory power.

Second, our findings highlight the importance of endogenous budget balance analysis. We found that the opportunity cost under the VAT regime is higher than that under VAT&APT regime, and the induced congestion cost plays a critical role in driving this difference. Hence, VAT regime provides less incentive for local government to provide public services than public capitals. Therefore, although the relative tax base of VAT to property tax is independent of the public good mix, the incentive of the two tax regimes is distinctive by taking into account the expenditure side, which is consistent with the vast literature that property tax provides more incentive for public service provision.

Third, these findings provide an insightful view on China's economic growth pattern. Although many studies have attempted to understand the incentives of intergovernmental competition for accounting for China's economic development (Cai and Treisman, 2004; Bai et al., 2007; Weingast, 2006; Zhou Li-an, 2010), these studies failed to well explain the city performance such as high housing prices, high saving rates, large city size in big cities in the course of China's economic growth, because their analyses are not conduced in the context of tax competition. Our study understood local government incentives for choosing among multiple local public goods under different financing regimes to account for the capital-intensive economic growth pattern of China in a cross-city spatial equilibrium framework. This study provided additional evidence among the few studies from an urban accounting context to understanding China's growth.

Finally, the adoption of the numerical analysis on the tax regime reform in this study is a significant contribution, given that no data is currently available for the residential property tax. In addition, the specific form of the model also enabled us to examine the political economics on the city's response to the

residential property tax reform, which fill the gap in literature that few were observed.

6.3 Extensions

(1) Endogenous Housing Supply Elasticity and Land Use Regulation

This study mainly focused on the public service and the public capital in the traded goods sector, while the public capital input for the non-traded goods production has not been much analyzed. As a direct extension of this study, analogous analysis can be applied to the public goods choice between public capital in the non-traded sector and the public service.

Housing supply elasticity depends on the supply of local non-traded capital, which is de facto the land input in the housing service production. Therefore, the housing supply elasticity is endogenized with the public goods choice. The land supply is regulated by local government's preference, local natural amenities, local productivity and governance efficiency. Therefore, a further extension can be conducted is on the relationship between the endogenous housing supply elasticity and the land use regulation. The impacts of land use regulations on housing rental price, local wage rate and city size can also be examined with our model. Literature on this issue is usually found to assume exogenous land use regulation and therefore the housing supply elasticity is treated as invariant (see Fu et al. 2010 for a review). This study endogenizes the housing supply elasticity, which fills the gap of the extant literature.

(2) Welfare Analysis and Land Rent Allocation

This study can be further extended to analyze the alternative schemes of land rent allocation to indicate the welfare effect.

In an open economy with both capital and labor freely mobile, the product

market is perfectly competitive, where both the firms and builders will receive -zero economic profit at equilibrium. Hence, the differential housing price reflects the resource cost of the scarcity input which refers to land input. The land market is monopolistic in China, therefore, although the land supply would adjust to equalize the equilibrium land rent cross sectors when the land market was perfect competitive, there remains the differential land rents cross sectors.

The welfare of the economy is determined by the land rent allocation in an open economy. Following the logic from Glaeser(2012), this study considers the land rent allocation under the two alternative allocation schemes to provide insights on the land management system reform in China. Given that the initial non-traded sector's land rent belongs to the old residents, the two allocation schemes with respect to the non-traded incremental land rent can be investigated: first, the non-traded incremental land rent belongs to local government, which is included in the local fiscal revenue used for public goods provision; second, the non-traded incremental land rent is equally shared among all residents, which is included in the resident's income for private goods consumption. It can compare the aggregate land rent under the alternative allocation scheme to examine the welfare effect. If under the scheme of the non-traded incremental land rent accrued to the government, the aggregate land rent is higher than that under the alternative scheme, then it would imply the current land rent allocation system may be more efficient, vice versa.

The land management system reform is another critical issue in China, which however few studies have been rigorously conducted. The findings of this study will provide important policy implications.

(3) Efficient Multi-public Goods Financing in A Spatial Equilibrium Model

The efficient financing of multiple-public goods can be examined in an

endogenous balanced budget framework of spatial equilibrium.

The conventional efficient pricing of public goods is often based on Lindahl equation, which argues that an efficient pricing of a public good should be based on the marginal benefit of the public good equal to the marginal cost. For a public service, if government charges the head tax equal to the marginal utility of the public service, then the supply of the public service would be anticipated to be at the optimal situation; for public capital, if the marginal product of the public input equals its supply cost, then, the optimal supply can be met. However, this approach may not work in an endogenous spatial model, when both the tax revenue and expenditures are endogenous, as the marginal benefit of the public service cannot be measured only by the marginal utility of the individuals, which affects the production indirectly, similar reasoning for public capital. This endogenous balanced budget pricing analysis in a spatial model, particularly with the endogenous prices and city size, has received less attention.

(4) Others

Our framework can be utilized to examine other issues. First, the model is ready to investigate the impacts of natural amenities on the public goods choice. The public service expenditure is affected by the quality of the natural amenity. It is anticipated that cities with better natural amenity endowments will tend to spend have more incentive for public service provision, as the opportunity cost will be smaller.

Second, one can further investigate the different response of heterogeneous cities to property tax reform. Our study provides a preliminary attempt on the examination of the different types of cities with respect to the capital intensity, public capital factor share and household preferences numerically. Further extension of this study can be conducted in the analytical framework.

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Appendix A The Marginal Tax Effect of VAT on Traded Goods Output

The marginal tax effect of VAT on traded goods is $\frac{\partial \ln Q_T}{\partial \tau_v}$ in Eq.(4.5) , the constant in Eq.(4.5) is

$$-\frac{1-(1-\mu)(1-\beta)}{M}+1=-\frac{(\mu+\beta-\mu\beta)(1-\alpha\gamma+\omega)-(1-\alpha+\omega)(1-\beta)\mu\eta}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)} \qquad (A.1)$$

$\because 1-\alpha\gamma+\omega>1-\alpha+\omega$

$$\therefore \frac{(\mu+\beta-\mu\beta)(1-\alpha\gamma+\omega)-(1-\alpha+\omega)(1-\beta)\mu\eta}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}>\frac{\left[1-(1-\mu-\mu\eta)(1-\beta)\right](1-\alpha\gamma+\omega)}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}$$

$$\because \frac{\left[1-(1-\mu-\mu\eta)(1-\beta)\right](1-\alpha\gamma+\omega)}{(1-\alpha+\omega)(1-\beta)\mu\eta+(\mu+\beta-\mu\beta)(\alpha\gamma-\omega)}>0$$

$$\therefore -\frac{1-(1-\mu)(1-\beta)}{M}+1<0$$

Therefore, the marginal VAT effect on traded good output is negative.

Appendix B Calculation of Marginal Effect of Each Public Good on Local Government's Utility

The marginal utility of public capital Z_T :

$$\frac{\partial U_g\left(Q_T+(1+\tau_P)\cdot PQ_H,\Theta\right)}{\partial Z_T}=\upsilon\cdot\frac{\lambda_A^B\cdot\alpha\gamma\cdot\frac{Q_T}{Z_T}+(1+\tau_P)\cdot\lambda_A^B\cdot\alpha\gamma\cdot\frac{PQ_H}{Z_T}}{Q_T+(1+\tau_P)\cdot PQ_H}\cdot U_g=\upsilon\cdot\lambda_A^B\cdot\alpha\gamma\cdot\frac{U_g}{Z_T} \quad (B.1)$$

The marginal utility of public capital Z_H :

$$\frac{\partial U_g\left(Q_T+(1+\tau_P)\cdot PQ_H,\Theta\right)}{\partial Z_H}=\upsilon\cdot\frac{\lambda_H^B\cdot\mu\eta\cdot\frac{Q_T}{Z_H}+(1+\tau_P)\cdot\lambda_H^B\cdot\mu\eta\cdot\frac{PQ_H}{Z_H}}{Q_T+(1+\tau_P)\cdot PQ_H}\cdot U_g=\upsilon\cdot\lambda_H^B\cdot\mu\eta\cdot\frac{U_g}{Z_H} \quad (B.2)$$

The marginal utility of urban amenities θ :

$$\begin{aligned}\frac{\partial U_g\left(Q_T+(1+\tau_P)\cdot PQ_H,\Theta\right)}{\partial\theta}&=\frac{\partial U_g\left(Q_T+(1+\tau_P)\cdot PQ_H,\Theta\right)}{\partial\Theta}\\&=\upsilon\cdot\frac{\lambda_\theta^B\cdot\frac{Q_T}{\Theta}+(1+\tau_P)\cdot\lambda_\theta^B\cdot\frac{PQ_H}{\Theta}}{Q_T+(1+\tau_P)\cdot PQ_H}\cdot U_g+(1-\upsilon)\cdot\frac{U_g}{\Theta}\\&=\left(\upsilon\cdot\lambda_\theta^B+1-\upsilon\right)\cdot\frac{U_g}{\Theta}\end{aligned} \quad (B.3)$$

So, the marginal effect of each public good on local government's utility is,

$$\frac{\partial \ln U_g\left(Q_T+\left(1+\tau_P\right)\cdot PQ_H,\Theta\right)}{\partial \ln Z_T}=\upsilon\cdot\lambda_A^B\cdot\alpha\gamma \qquad (B.4)$$

$$\frac{\partial \ln U_g\left(Q_T+\left(1+\tau_P\right)\cdot PQ_H,\Theta\right)}{\partial \ln Z_H}=\upsilon\cdot\lambda_H^B\cdot\mu\eta \qquad (B.5)$$

$$\frac{\partial \ln U_g\left(Q_T+\left(1+\tau_P\right)\cdot PQ_H,\Theta\right)}{\partial \ln \theta}=\left(\upsilon\cdot\lambda_\theta^B+1-\upsilon\right)\cdot\frac{\theta}{\Theta} \qquad (B.6)$$

Therefore, the elasticity of substitution between public capital and public service is,

$$\frac{\dot{Z}_T}{\dot{\theta}}=\frac{\upsilon\cdot\lambda_\theta^B+1-\upsilon}{\upsilon\cdot\lambda_A^B\cdot\alpha\gamma}\cdot\frac{\theta}{\theta+\underline{\theta}} \qquad (B.7)$$

$$\frac{\dot{Z}_T}{\dot{\theta}}=\frac{\upsilon\cdot\lambda_\theta^B+1-\upsilon}{\upsilon\cdot\lambda_H^B\cdot\mu\eta}\cdot\frac{\theta}{\theta+\underline{\theta}} \qquad (B.8)$$

Appendix C China's Fiscal System

C1. Background of China's Fiscal Reforms

After the establishment of People's Republic of China in 1949, it gradually reformed its tax regime to accommodate the transformation of its economy to socialist. The socialist transformation was undergone gradually from 1949 to 1956. Between 1949 and 1952, the economy was mixed with public and private economies; therefore, in order to suit the multi-ownership system, many categories of taxes were imposed on goods and services and on personal incomes and several local taxes were classified. Taxes on goods and services are similar to the turnover tax[22]. Local taxes at this time included the Stamp Tax, Inheritance Tax, Transaction Tax, Slaughter Tax, House Tax, Land Tax, Specific Consumption Tax, and Vehicles and Vessel License Tax. As the economy recovered rapidly from the wars that occurred prior to its establishment[23], fiscal revenues from industrial and commercial taxes were doubled in 2 years. The most important taxes during this period were the taxes on goods and services (turnover tax).

Between 1953 and 1957, the socialist reconstruction was initiated to nationalize the capitalist industrial and commercial enterprises and collectivize small businesses and agriculture. By 1956, the socialist transformation had been almost completed, leaving a very small portion of private economy with most of the socialist economy. The tax revenue from the socialist sector increased from 57 percent of total tax revenue in 1956 to 96.7 percent in 1957.

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[22] Taxes on goods and services included Commodity Tax, Industrial and Commercial Business Tax, Salt Tax, and Customs Duties. Industrial and Commercial Business Tax includes business income tax, a turnover tax, and a number of less important taxes such as the commercial license tax and the street traders tax. Taxes on personal incomes include Wages and Salaries Income Tax and Interest Income Tax, but Wages and Salaries Income Tax was initiated in 1980. Jinyan Li(1991),"Taxation in the People's Republic of China", New York, Westport.

[23] Anti-Japanese War (1937-1945) and the Civil War (1945-1949).

The whole economy was highly controlled by the central government. During 1958 to 1978, the "leftist"[24] simplified the previous complicated tax system several times until it finally had only one single tax with equal tax rate for all enterprises in the same industry: the Industrial and Commercial Tax (ICT)[25]. Therefore, the only tax of any importance was also a form of turnover tax.

During the period between 1949 and 1978, China was a highly centralized-planning economy. The state controlled almost all major economic activities throughout the state-own enterprises (SOEs). Central government obtained full surplus from the SOEs. Taxation was utilized as an instrument for transferring part of the profit from state enterprises to tax offices, mobilizing resources within the public sector. This is different from many western countries where taxation was used instead as a policy instrument for distributing resources from the private sector to the public sector. The local government acts as an agent of the central government for carrying out the central policies without fiscal autonomy.

Until the end of 1978, the "open economy" reform called for a fundamental fiscal reform, as the economy was open up to foreign enterprises, and the township and village enterprises (TVEs) and the private enterprises were burgeoned. Therefore, in order to accommodate the multiple ownerships of enterprises in the economy, several reforms were initiated consecutively from 1979 to 1988. These reforms were known as "eating from separate kitchen", referring to the division of the central and local expenditures and revenues. The reforms culminated in a "fiscal contracting system" reform in 1988 which was one of the most significant fiscal reforms in China.

[24] The "leftist" theory suggested that the socialism needs no taxation.
[25] State enterprises were only subject to the Industrial and Commercial Tax on the turnovers, while some provinces would impose Industrial and Commercial Income Tax on the collective enterprises' profit.

C2. "Fiscal Contracting System" Reform in 1980s

As the open economy reform started, income tax law was promulgated in 1980 for foreign and private enterprises. Facing competitions from non-state enterprises, the state enterprises initiated "tax for profit" reforms aiming to increase their productivities. The "tax for profit" reform was gradually implemented. It was firstly experimented in the early 1979 to allow the state enterprises to retain part of the profits to expand the production and reward their workers. This experiment had great successes as the enterprises that undergone the experiment had experienced a growth rate of 3 to 4 times greater than those that had not undertaken the experiment. Later, the reform substituted the profit remittance with income tax in 1983, but part of the after-income-tax profits were still needed to submit to the state. Since the product price and natural resource allocation and capital investment were highly controlled by the central government, this reform did not provide much incentive for the state enterprises to increase their productivity. Therefore, in 1984, an additional reform permitted SOEs to retain the after-income-tax profits. In addition, as the TVEs and private enterprises developed, the income taxes designated for these enterprises were also promulgated.

After "tax for profit" reforms on state enterprises, profits varied enormously across state enterprises due to the differences in initial capital investment, access to natural resources, and the locations of the markets, which undermined the fair competition in a market economy. Hence, multiple taxes had to be introduced to regulate the profit levels. In 1984, a turnover tax reform was initiated, which replaced the uniform ICT with four types of taxes including the Product Tax, Value-added Tax (VAT), Business Tax and Salt Tax. These taxes were imposed on domestic goods and services. The Consolidated Industrial and Commercial Tax (CICT) [26]was unfolded from ICT to levy on foreign goods and services.

[26] CICT was introduced in 1958 and was folded into ICT in 1973.

Meanwhile, significant reforms on the land use system were initiated, which is associated with the economic reform after 1978. Land use was allocated by the central government during the planning period between 1949 and 1978 and its use was free of charges. In 1979, as foreign enterprises were entering China's market, land was utilized by the government as a collateral investment for establishing joint-venture enterprises. Later in 1982, the land use tax was firstly charged by Shenzhen, which facilitated the Land Use Tax to be stipulated in local tax revenue in 1985. A detailed tax assignment stipulated in the regulation on fiscal system was issued in 1985[27] (Table C2.1).

Table C2.1 Tax structure in 1985

Center taxes	
Taxes on goods and services	⑴Product Tax, VAT and Business Tax collected by customs on goods imported and exported; ⑵Business Tax on enterprises under Ministry of Railways, banks and insurance companies, enterprises producing petroleum, electricity, petroleum chemical and nonferrous metals; ⑶Special Oil Burning Tax; ⑷Consolidated Industrial and Commercial Tax on foreign enterprises engaged in offshore oil exploration; ⑸Customs Duties.
Income Tax	⑴State Enterprises Income Tax under central control; ⑵State Enterprises Income Regulatory Tax under central control; ⑶Income Tax on foreign enterprises engaged in offshore oil exploration.
Local Taxes	
Income Tax	⑴State Enterprises Income Tax under local control; ⑵State Enterprises Income Regulatory Tax under local control; ⑶Collective Enterprises Income Tax.
Property-type Tax	⑴Urban Real Estate Tax; ⑵Land Use Tax; ⑶Real Estate Tax(Housing Tax);

[27] "Regulations on Implementing a Fiscal Management System of Classifying Taxes, Certifying Revenue and Expenditures and Each Level of Government Being Individually Responsible," issued by the State Council on March 21, 1985.

	⑷Vehicle and Vessel License Tax; ⑸Vehicle and Vessel Use Tax[28]; ⑹Contract Tax.
Others	⑴Slaughter Tax; ⑵Livestock Transaction Tax; ⑶Market Transaction Tax; ⑷Agricultural Tax; ⑸Animal Husbandry Tax; ⑹Urban Maintenance and Construction Tax.
Shared Taxes	
Taxes on goods and services	⑴Product Tax, VAT, Business Tax, except those allocated to central revenues exclusively; ⑵Salt Tax; ⑶Consolidate Industrial and Commercial Tax on foreign enterprises except those engaged in offshore oil exploration.
Income Tax	⑴Income Tax on foreign enterprises, except those engaged in offshore oil exploration; ⑵State Enterprises Bonus Tax; ⑶Individual Income Tax.
Property-type Tax	Resource Tax.
Others	Construction Tax.

Central taxes included the Product Tax, both the VAT and Business Tax collected by customs on goods imported and exported; the Business Tax on enterprises under the Ministry of Railways, banks and insurance companies, enterprises producing petroleum, electricity, petroleum chemical and nonferrous metals; the Special Oil Burning Tax; the CICT and the Income Tax on foreign enterprises engaged in offshore oil exploration; the Customs Duties; the State Enterprises Income Tax and Income Regulatory Tax on state enterprises under central control.

Local taxes were defined in terms of retaining all tax revenues at the local level[29]. Local taxes included the State Enterprises Income Tax and Income Regulatory Tax on state enterprises under the local control; the Collective

[29] We will come to the detail analyses on local taxation autonomy later.

Enterprises Income Tax; the Urban Real Estate Tax; the Real Estate Tax; the Land Use Tax; the Vehicle and Vessel Use Tax; the Vehicle and Vessel License Tax; the Contract Tax; the Slaughter Tax; the Livestock Transaction Tax; the Market Transaction Tax; the Agricultural Tax; the Animal Husbandry Tax; the Urban Maintenance and Construction Tax (UMCT). Among those local taxes, the Land Use Tax, Real Estate Tax and Vehicle and Vessel Use Tax were not enacted immediately after the implementation of this regulation, but later in 1988, 1986 and late 1985, separately. In addition, the Banquet Tax and the Stamp Tax were later introduced as a local tax source in 1988.

Shared taxes included the Product Tax, VAT, and Business Tax (except those exclusively allocated to central revenues); the Salt Tax; the CICT and the Income Tax on foreign enterprises except those engaged in offshore oil exploration; the State Enterprises Bonus Tax; the Individual Income Tax; the Resource Tax; the Construction Tax.

C.2.1 The Turnover Taxes

The major turnover taxes before 1988 included the Product Tax, VAT, Business Tax, Salt Tax, Special Oil Burning Tax and CICT.

The Product Tax was levied on industrial product during the manufacturing and import stage and on the agricultural products during the purchases. It was exerted on 270 different types of products with 26 differential tax rates. It was the most important tax revenue source at the time. The VAT was levied on some selected products that had been subjected to serious cumulative taxation under ICT. The categories of taxable goods were increased from the original 2 to 24 by 1988. The Business Tax was similar to the Product Tax, which however was levied on services and trades. The collective and private enterprises were the major tax payers. The Salt Tax was an excise tax that levied on salt producers and distributors. The Special Oil Burning Tax was an

excise tax on oil consumption[30]. The CICT was levied on foreign enterprises.

In 1985, the turnover tax contributed to the total tax revenue at 46.72 percent, while the ratio was increased to 52.84 percent in 1988[31]**.** At the local level, from Table C2.1, it seems that there were fewer turnover taxes exclusively belonging to local tax sources, which were mainly in the form of shared taxes to contribute to the local tax revenue. The shared tax revenue, retained by the local government was based on negotiation between the central and local governments.

The central-local revenue sharing scheme had involved 3 categories. In 1980, the revenue sharing scheme was based on a formula that identified the share as the ratio of fiscal expenditure to the revenue at the base year of 1979 with the fiscal surplus shared at that ratio between central and local, while the fiscal deficits would receive transfers from the central. This sharing scheme is called "proportional sharing system". In 1985, the central local revenue sharing scheme was adjusted to the new tax assignments. Local and shared tax revenues were shared among central and local, except the central exclusive taxes, at the proportional rate that was determined by local expenditure to revenue. In 1988, the "fiscal contracting system" delinked the tax revenue and expenditure relationship to submit a fixed number of revenue to central. The local government's role was shifted from providing local public service to financing public expenditure.

This shared scheme provided the local government with greater rooms to "game" with the central government and finally had managed to retain most of them at the local level.

[30] The purpose of levying this tax is to limit the consumption of the oil in order to encourage its use for production.

[31] Data on turnover tax can only be obtained from 1985 in China Financial Yearbook

C.2.2 The Property-type Taxes

The major property-type taxes that related to real estate by 1988 were the Urban Real Estate Tax, Land Use Tax and Real Estate Tax.

The Urban Real Estate Tax was levied on foreign enterprises and individuals. Land Use Tax included the Farmland Use Tax and Urban Land Use Tax. Both taxes were levied on users for using lands (Farmland Use Tax is for using agricultural land as non-agricultural activities) based on areas subject to various rates depending on location. Real Estate Tax was levied on domestic individuals, work units, enterprises who owned housing property.

Table C2.1 shows that the property-type taxes were merely found as exclusively central tax sources, but mainly as local taxes; however, they played a very limited role in local tax revenue. This observation was important, as it then provided rooms for the local government to shift to "land financing".

C.2.3 Expenditure Responsibility

Along with the revenue sharing in 1985, the expenditure responsibilities were greatly decentralized. The State Council Supplementary Regulations on the Implementation of the "Tax Assignment System" had a broad assignment of central and local government expenditure responsibilities. The central government's responsibility was mainly focused on national defense, economic development, and the administration of national institutions. More specifically, these include the national defense, administrations, management of central SOEs, capital spending, the technical renovation of central enterprises and new product development, geological survey, agricultural supports, universities, and research institutes.

The local governments are responsible for social security and safety, local public service provisions, local economic developments, and local institution administration. More specifically, these include the military police and militia,

unemployment insurance, poverty alleviation, price subsidies; primary and secondary schooling, large portion of higher education, health care and hospitals, cultural and heritage protection, environmental protection; management of local SOEs, local capital investment, the technical renovation of local enterprises and new product development, agricultural supports, urban maintenance and construction, local and regional roads, highways, waste water collection and treatment, garbage collection and disposal, urban gas supply, and mass transit; and administration.

There is no explicit classification of the expenditure items into investment and recurrent expenditures. The following Table C.2.3.1regrouped these items into capital investment for economic development, housing service investment, public service and others.

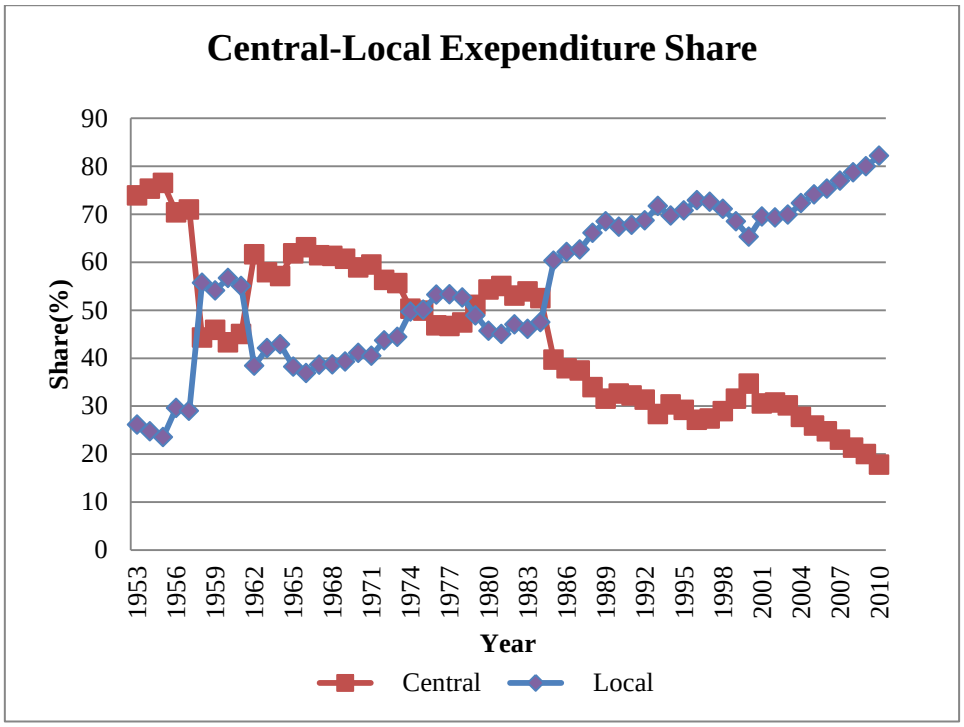
Table C.2.3.1 Expenditure responsibilities at central and local levels

Central expenditures	
Economic development	⑴capital spending; R&D; ⑵management of central SOEs.
Housing service investment	-
Public service	⑴national defense; ⑵universities and research institutes; ⑶hospitals.
Others	Administration of national institutions.
Local expenditures	
Economic development	⑴management of local SOEs; ⑵local capital investment; ⑶the technical renovation of local enterprises and new product development; ⑷agricultural supports; ⑸urban maintenance and construction; ⑹regional roads, and highways.

Housing service investment	⑴Affordable housing; ⑵Local infrastructures: water supply and distribution; waste water collection and treatment; garbage collection and disposal; urban gas supply; mass transit; ⑶local roads.
Public service	⑴the military police and militia; ⑵unemployment insurance; ⑶poverty alleviation; ⑷price subsidies; ⑸primary and secondary school; ⑹healthcare; ⑺cultural and heritage protection; ⑻environmental protection.
Others	Administration of local institutions.

The most important unit of local government for the local public service provision in China is at the county level in most provinces. The county spent about 70 percent of the total sub-provincial education expenditures and 55 to 60 percent of the health expenditure. Comparing with many other countries, the education and healthcare are usually the responsibilities of the provincial or central governments. In addition, prefectural and county level governments in China are responsible for the unemployment insurance, social security, and welfare, which are generally the federal government's responsibilities in many other countries.

Local expenditure share after 1988 when the "fiscal contacting system" reform culminated increases dramatically to nearly 70 percent of total expenditure while the central expenditure is decreased (Figure C.2.3.1).



Source: China Financial Yearbook 1953-2010

Figure C.2.3.1 Central-local expenditure share

C.2.4 Issues with the "Fiscal Contracting System"

These reforms separated the central and local tax sources, which were often known as "eating from separate kitchen". Under this tax system, despite the local governments being assigned with several local tax sources exclusively, there were little tax autonomy, given that the tax bases and tax rates were designed by the central government. Local tax laws were promulgated by the central government; the local government can introduce the implementing rules and grant the tax deduction and exemption with respect to the local taxes. In addition, local governments were responsible for most tax collections including those of central taxes. Hence, despite having no formal taxation autonomy at the local level, the authority in collecting almost all taxes and granting tax deduction and exemption provided them a certain degree of capability to "game" with the central government. Moreover, the local governments were essentially the owners of local SOEs and the collective

enterprises. They were motivated to reduce efforts in collecting VAT in order to leave the profits from those accrued to the local revenue.

The local government was able to avoid the shared taxes by reducing their taxing efforts. As a result, the central fiscal revenue share decreased for 5 consecutive years from 1985 to 1989 (Figure C.2.4.1), while local fiscal revenue share increased, during the worst cases, the central government borrowed from the local governments[32]. In addition, the fiscal revenue to GDP decreased from 22.23 percent in 1985 to 15.68 percent in 1989.

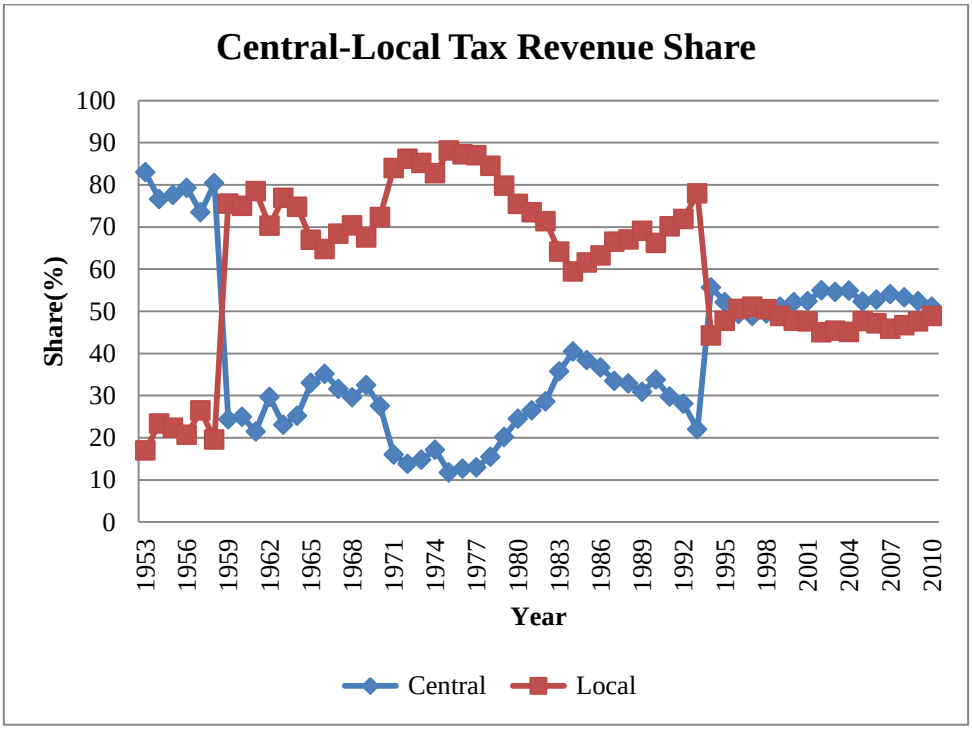
It was observed that during 1984 to 1988, there was increasing "investment hunger" at the local level: total capital investment increased at 20 percent annually, of which the state-owned enterprises increased at 18.94 percent while the collective-owned enterprises increased at 35.8 percent. The collective-owned enterprises are mainly owned by local governments. The increase in local capital investment could be driven by the aim of increasing profits that were retained for local enterprises for investments and other uses.

The budgeting process followed the bottom-up-down procedure. The local government firstly reports on the budget plan to the central government, who then summarizes all plans and then makes a final plan, which then is distributed to the provincial governments. The provincial government then assigns the targets to the lower level of governments. The accomplishment of the targeted budget was used as a valuation for the local officials. Therefore, this fiscal decentralization was primarily administrative decentralization with a highly centralized political system.

There are flaws with the tax structure in this tax system. Firstly, the Product Tax, VAT and Business Tax have similar functions although different tax bases. Secondly, the limited local tax revenue capacity was unable to meet the expenditure needs, which induced the local government to abuse fees and

[32] Central government borrowed from local government through setting up two funds: one is "pivotal national energy and transportation construction fund " in 1982 and "national budget adjustment fund" in 1989, both of which were abolished in 1995.

charges.



Source: China Financial Yearbook 1953-2010

Figure C.2.4.1 Central-local tax revenues

C3. "Tax Assignment System" Reform in 1994

Facing the problem of decreasing ratios from both central to total revenue and fiscal revenue to GDP in the 1980s, the "tax assignment system" reform was initiated in 1994, which was another critical fiscal reform in China. A major reform was extending the VAT to all turnovers and eliminating the product and business tax on many industrial products. Other reforms included (i) unifying the income taxes on domestic enterprises with different ownerships and individuals separately. For example, both the local and central State Enterprises Income Tax and Income Regulatory Tax, the Collective Enterprises Income Tax, and the Private Enterprises Income Tax were unified into the Enterprises Income Tax; the Individual Income Tax and the Bonus Tax were combined into the Individual Income Tax; (ii) abolishing the Special Oil

Burning Tax, Market Transaction Tax, and Livestock Transaction Tax; (iii) the Slaughter Tax, Banquet Tax, and Animal Husbandry Tax were decentralized to be exclusively local taxes and the local government were offered the authority to determine whether to terminate the former two taxes at their own jurisdiction. These reforms simplified the tax structure and resolved some of the problems of the duplicate taxation on some goods. For the detailed tax assignment for this "tax assignment system", please refer to Table C3.1.

Table C3.1 Tax Structure in 1994

Center taxes	
Taxes on goods and services	⑴VAT and Consumption Tax collected by customs on goods imported and exported; ⑵Business Tax on enterprises under Ministry of Railways, banks and insurance companies, enterprises producing petroleum, electricity, petroleum chemical and nonferrous metals; ⑶Consumption Tax; ⑷Customs Duties.
Income Tax	⑴Income Tax on state enterprises under central control; ⑵Income Tax on foreign enterprises engaged in offshore oil exploration.
Others	⑴Urban Maintenance and Construction Tax on enterprises under Ministry of Railways, banks and insurance companies, enterprises producing petroleum, electricity, petroleum chemical and nonferrous metals.
Local Taxes	
Taxes on goods and services	Business Tax on enterprises, except those enterprises of Railways, banks and nonbank financial institutions, insurance companies.
Income Tax	Income Tax on state and collective enterprises under local control.
Property-type Tax	⑴Urban Real Estate Tax; ⑵Land Use Tax; ⑶Real Estate Tax; ⑷Land Value Incremental Tax; ⑸Fixed Asset Adjustment Tax; ⑹Vehicle and Vessel Use Tax; ⑺Vehicle and Vessel License Tax; ⑻Contract Tax.

Others	⑴Slaughter Tax; ⑵Livestock Transaction Tax; ⑶Market Transaction Tax; ⑷Agricultural Tax; ⑸Animal Husbandry Tax; ⑹Banquet Tax; ⑺Stamp Tax; ⑻Urban Maintenance and Construction Tax except those allocated to central revenues exclusively.
Shared Taxes	
Taxes on goods and services	⑴VAT, except those allocated to central revenues exclusively(central to local: 3:1); ⑵Stamp Taxes on Security Exchange(central to local 1:1).
Property-type Tax	Resource Tax.

The "tax sharing system" specified the central tax sources[33] including import tariffs, consumption taxes, income taxes, import-related consumption taxes and VATs, business, company income, and UMCTs on banks, nonbank financial institutions and insurance companies, and taxes on railroads. Except for the UMCT that is added, much is similar to the central taxes as the "fiscal contracting system".

Local tax sources include income taxes, business, company income, and urban maintenance and development taxes on businesses excluding banks, nonbank financial institutions and insurance companies and railroads, personal income tax, urban land use tax, fixed assets capital gains tax, house property taxes, stamp taxes, agriculture and related taxes, tax on contracts, and land value incremental taxes. Relative to the "fiscal contracting system", local tax resources are added with the Land Value Incremental Tax and Fixed Asset Adjustment Tax. UMCT is shared among central and local.

Sharing tax sources include value added taxes, stamp taxes on security

[33] Central fiscal revenue includes profits of SOEs under the jurisdiction of the central government and local fiscal revenue includes profits of SOEs under the jurisdiction of the local government.

exchange, and resource taxes. Value-added tax shared among central and local with 3:1. The share of the Stamp and Security Tax was changed to be 88:12 for central to local.

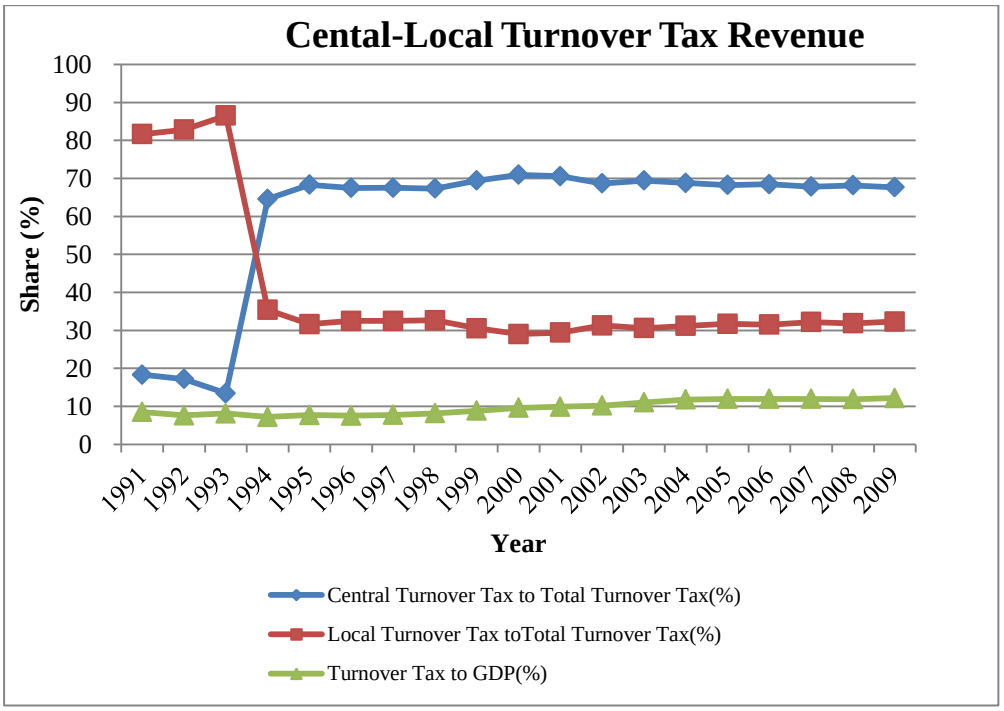
In addition, the tax collection bureau was divided into central and local tax revenues. Central tax bureau collected central exclusive taxes and shared taxes while local tax bureau collected local taxes.

C.3.1 The Turnover Tax

In 1993, the Consumption Tax was initiated to levy on particular products such as wine, cigarette, etc., in the course of their productions, which was similar to the excise tax. The Product Tax was folded into the VAT and Consumption Tax. The Salt Tax was separated into the VAT and Resource Tax. By 1994, the turnover tax consists mainly of the VAT, Consumption Tax, and Business Tax. The Consumption Tax was as an exclusive central tax, Business Tax sources were divided for central and local exclusive taxes[34], and VAT was a sharing tax between central and local at 3:1. These 4 types of turnover taxes continue to exist presently. The following figure shows the turnover tax revenue in 1991-2009[35].

[34] Business Tax on banks, nonbank financial institutions and insurance companies and railroads were exclusive central tax, others were local tax.

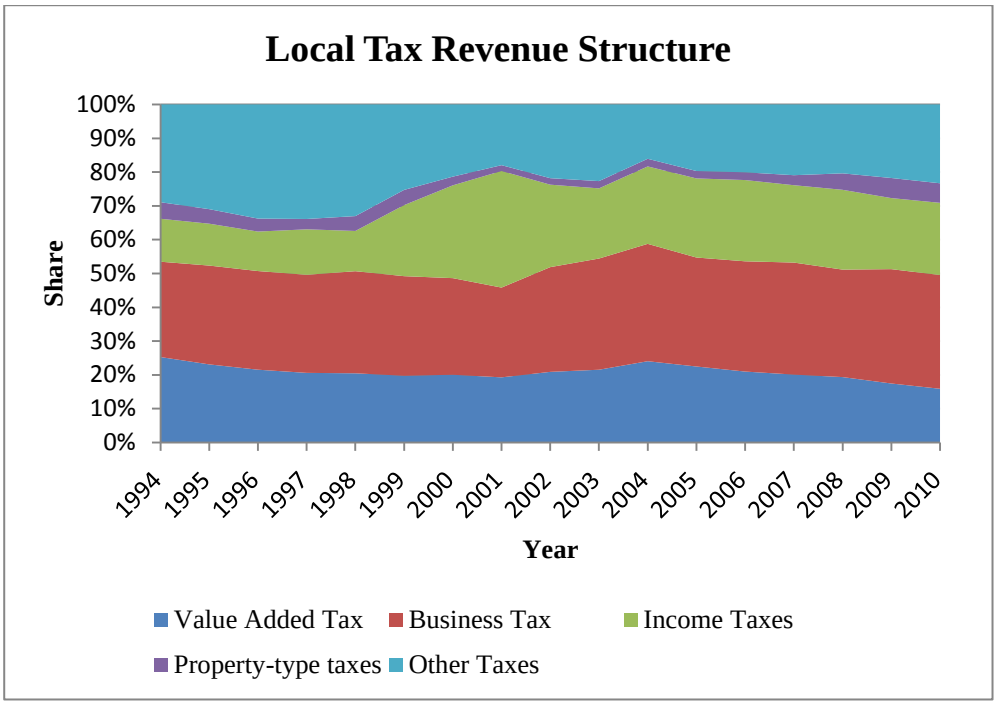
[35] The central turnover tax in the figure included the VAT, Business Tax, Consumption Tax, and Product Tax (before 1994). The local turnover tax in the figure includes VAT and Business Tax.



Source: author self-complied from China Financial Year Book

Figure C.3.1.1 Turnover tax revenue during 1991-2009

Figure C.3.1.1 shows the turnover tax shared between central and local. It shows that the total turnover tax to GDP has a relatively stable share cross times. However, the share of central and local turnover tax has dramatically overturned after 1993 when the “tax sharing system” was implemented. The central turnover tax share has increased with more than half of the total tax revenue. Correspondingly local turnover tax share decreased with more than half of the total tax revenue.



Source: author self-complied from China Financial Year Book 1994-2010

Figure C.3.1.2 Local tax revenue composition

Figure C.3.1.2 shows the composition of the local tax revenues. It shows that the VAT and the Business Tax (together compose the broad definition of the VAT) played a critical role in local tax revenue. The significant role of the turnover tax is far beyond this, after accounting for the tax rebates.

The "tax rebate" system was initiated in 1993 for the purpose of obtaining support of the local government toward the "tax assignment system" reform. The central government committed to return a portion of VAT revenue from the central-shared to the local government to maintain their previous expenditures as in 1993. In addition, the central government also committed to return 30 percent of the incremental VAT and the Consumption Tax to the local government in order to prevent the avoidance of the taxing efforts. This "tax rebate" system established a pro-growth VAT-dominated turnover tax system.

C.3.2 The Property-type Tax

The major local property-type taxes are similar as before, which include the Urban Real Estate Tax, Land Use Tax, and Real Estate Tax. The Fixed Asset Adjustment Tax was abolished in 2000. The Vehicle and Vessel License Tax and Vehicle and Vessel Use Tax were combined as the Vehicle and Vessel Tax. The Urban Real Estate Tax was discontinued in 2009. The Tonnage Duty was resumed in 2001[36].

Figure C.3.1.2 also shows that the property-type tax consists of a small portion of the local tax revenue. The major property-type taxes have smaller tax bases in addition to the lower tax rates. For the Urban Real Estate Tax, the tax rate is 1.2 percent of the real estate value or 1.8 percent of the rental of the real estate. For the Real Estate Tax, the levies are 1.2 percent tax rate on the value of the housing property or 12 percent tax rate based on the rental income of the housing property. The non-business properties are exempted for this tax. The Land Use Tax is levied based on land area at a rate ranging from 1-10 yuan/m^2 for Farmland Use Tax and 0.3-10 yuan/m^2 for Urban Land Use Tax.

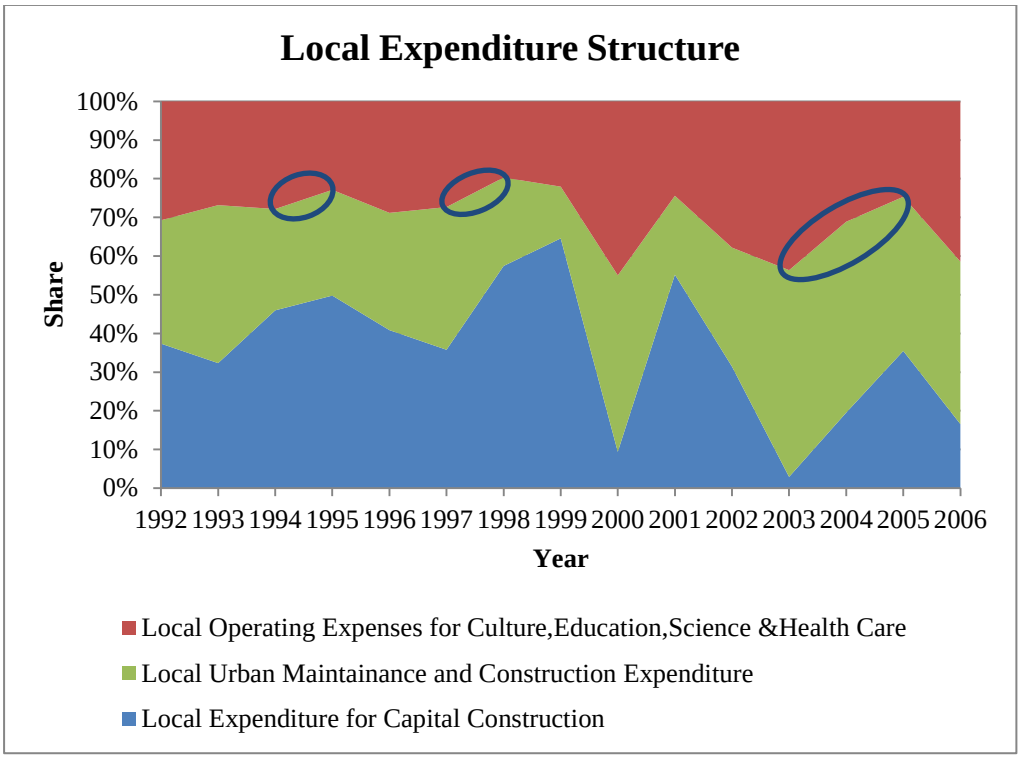
Therefore, the smaller contribution of the property-type taxes to local tax revenues is accounted for by the lower tax rates and the smaller tax bases, which excludes the residential properties. The property-type tax makes up lower than 10 percent of local tax revenue. Compared with property tax in other countries, the developed countries usually have property tax consists of a large portion. For example, in the United States 80 percent, Canada 84.5 percent, British 93 percent, and Australia 99.6 percent, while some Asian countries usually have property tax consisted of around 23 percent-54 percent[37]. Hence, China's local tax system has much smaller property tax revenue. There are many rooms for local government to increase local tax revenue by imposing property tax.

[36] The Tonnage Duty existed before 1985, but it was designated to the Ministry of Transportation in 1986, and later in 2001, it was resumed to be administered by the Ministry of Finance.

[37] http://www.kejianhome.com/lunwen/436/518/118398.html

C.3.3 Expenditure Responsibilities

The expenditure assignment inherited from the "fiscal contracting system" has little amendments. Local expenditure was increased from 70 percent of total expenditures in 1994 to 80 percent in 2009 (Figure C.2.3.1). Figure C.3.3.1 shows the local expenditure components after the "tax sharing system" reform.



Source: author self-complied from China Financial Year Book 1992-2006

Figure C.3.3.1 Local expenditure composition

Note:
In 1994-1995, the reduction of public service expenditure share was mainly caused by the 1994 "tax assignment reform". The public service expenditure reductions in 1997-1999 and 2003-2005 were caused by the two "land enclosure" movements, because local government tended to spend more public capitals to increase the land value.

Figure C.3.3.1 shows that local expensed more than 60 percent of fiscal revenues on capital construction, including capital construction, urban maintenance and construction expenditure. Especially, in the time frame of

1994-1995, 1997-1999 and 2003-2005, the public service expenditure share was reduced remarkably. In 1994-1995, the reduction of public service expenditure share was mainly caused by the 1994 "tax assignment reform," which implies that the fiscal reform contributed to the distortion of local government expenditures. While, on the other hand, the reductions in 1997-1999 and 2003-2005 were consistent with the two "land enclosure" movements that happened in China[38], which indicates that local government spent more on capital investment to increase the land rents

C.3.4 Issues with the "Tax Assignment System"

The tax system clearly assigned the central-local shared ratio on the shared tax revenues, in addition to the specification of the central and local exclusive tax sources. This tax system simplified the tax categories and tax rates, and controlled local government's authority in tax exemptions and deductions.

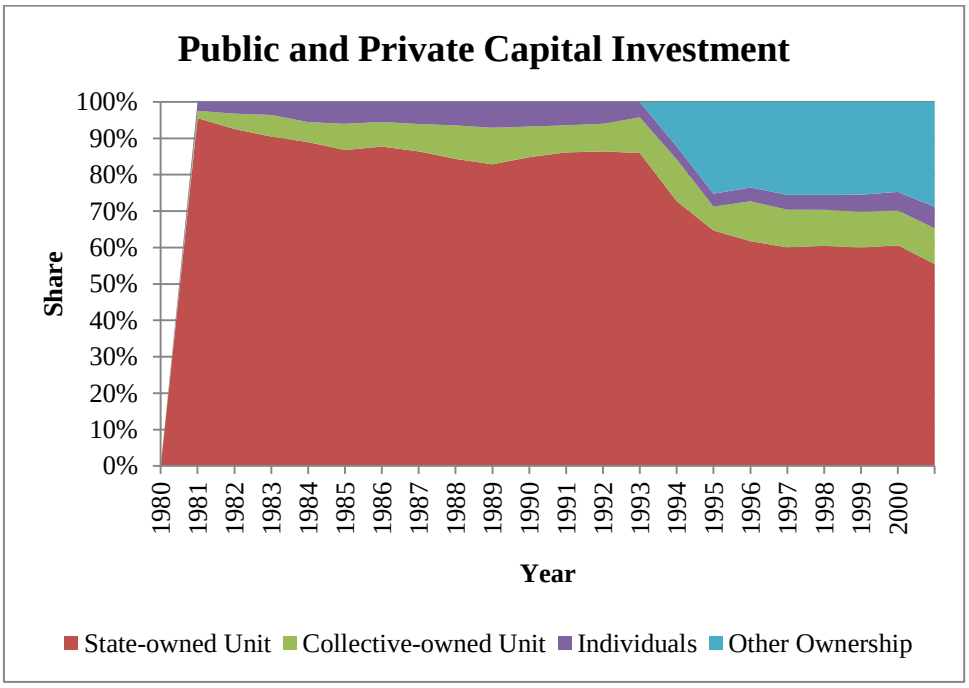
Similar as before, the weakness of the tax system has the overlapping function of the VAT and the Business Tax, which has been remedied by the initialization of turnover tax reform by incorporating the Business Tax into VAT recently. Another weakness of this tax system that similar to the "fiscal contracting system" is the small role of property-type taxes in local tax revenue.

In addition, the VAT adopted in China is a production-type VAT while the consumption-type VAT is often applied worldwide. There are three types of VAT utilized in practice worldwide depending on how to treat the capital investment in the tax base: the production-type VAT (or GNP-type VAT), income-type VAT, and consumption-type VAT. The taxable base of production-type VAT is the sales revenue deducting the value of intermediate product. The taxable base of income-type VAT is the sales revenue subtracting the depreciation of fixed assets and the intermediate product. The taxable base

[38] The reduction of public service expenditure in 2000-2001 was due to the fiscal stimulus package to cope with the financial crisis in 1998.

of consumption-type VAT is the sales revenue deducting the gross value of fixed assets purchased during the period in addition to depreciation of the fixed assets and the intermediate product.

The production-type VAT allows neither any deduction of the capital investment nor depreciation of the capital which discourages private capital investments. Relative to the income-type VAT and consumption-type VAT, production-type VAT has the largest tax base since private capital investments are included in the tax base. Hence, after the fiscal revenue decrease with the 1980's 'fiscal contracting system' reform, the production-type VAT was adopted, which is more advantageous than the other two in increasing the fiscal revenue.



Source: Statistical Yearbook of the Chinese Investment in Fixed Assets

Figure C.3.4.1 Public vs. private capital investment during 1980-2001

Figure C.3.4.1 shows that despite an increase of private capital investment after 1990 as a result of adopting production-type VAT, the public capital investment still played a dominant role in the total investment. Therefore, the

policy makers are considering to further reform the production-type VAT toward the consumption-type VAT to increase more private capital investment rather than public capital investment.

C4. Summary

China's tax system has evolved from a "fiscal contracting system" to "tax assignment system," which has greatly decentralized the fiscal sources to the local government as well as the expenditure responsibility. The current tax revenue system is dominated by VAT, where the local property tax plays a small role in local revenue generation. The "tax rebate" system with the VAT-dominated revenue system promotes the local government's incentive for local economic development, which distorts local expenditure choices toward favoring capital investment to public service provision. Moreover, the increasing local expenditures in excess of the local tax revenues have induced the local government to rely on "land financing" due to the lacking fiscal autonomy in setting local taxes, which was an extra-budgetary revenue. The reliance on "land financing" further enhanced the local government's incentive for public capital investment rather than public service provision.